# Physical activity, screen-based activities and their potential determinants

Kopčáková, Jaroslava

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## Active living during adolescence

**Jaroslava Kopčáková**

Thesis for the University of Groningen, the Netherlands – with summary in Dutch and Slovak


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# Physical activity, screen-based activities and their potential determinants
## Active living during adolescence

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# Contents

# 1 Introduction

Chapter 1

# Introduction

This thesis deals with physical activity and screen-based activities of adolescents and the associations of these behaviours with potential determinants (e.g. body image, motives to physical activity, school environment, degree of urbanization, perceived activity-friendly environment). This chapter explores the theoretical background of this research and describes the aim of the study, its theoretical model, its research questions and the structure of the thesis as a whole.

## 1.1 Active living during adolescence

Active living is an approach to life that values and includes physical activity in everyday living. Active living has been proposed as a core issue in adolescents' lives, based on the notion that good youth development requires more than just being free of risky health-related behaviours (Roth & Brooks-Gunn, 2003), i.e. a series of healthy behaviours is needed that all regard as being active. Lerner coined the phrase 'active living' as one of the important components of the Positive Youth Development theory (Lerner 2005). It was based on the premise that every individual possesses certain strengths which need to be nurtured through appropriate contextual assets. The need for active living during adolescence has substantially risen over the past decade (Zick, 2010). A recent study of Reis et al. (2016) appeals to the need to get people moving and to make the active living of adolescents a more desirable, affordable, and accessible choice. In addition, the new Canadian 24-Hour Movement Guidelines for Children and Youth emphasize the integration of all movement behaviours that occur over a whole day (i.e., light, moderate and vigorous physical activity, sedentary behaviour and sleep) (Latimer-Cheung et al., 2016). These guidelines shift the paradigm away from considering each behaviour in isolation.

## 1.2 Physical activity in adolescents

Adolescence is a period of extensive psychological change, such as the need to explore, growing independence and the need for peer acceptance and family support. Therefore, explaining physical activity is complex, especially in the target group of adolescents, since many accompanying physical, cognitive and social developmental changes are taking place.

Regular physical activity leads to physical and mental health benefits, which can make an important contribution to improving physical

and psychological quality of life (Penedo, Dahn, 2005). It may also improve academic and cognitive performance (Strong et al., 2005). Low levels of physical activity during adolescence contribute to obesity and poor health outcomes (Penedo, Dahn, 2005; Strong et al., 2005; Hallal et al., 2006; Iannotti et al., 2009; Sallis et al., 2016; Carson et al., 2016). The benefits of an active childhood can carry over into adulthood. Establishment of healthy patterns of physical activity during childhood and adolescence is important, because physical activity moderately follows during adolescence and from adolescence to adulthood (Telama et al., 2009). Further, physical activity plays an important role in establishing, enjoying and maintaining social relationships. Finally, it provides a direct benefit by contributing to physical appearance through increased fitness and strength, as well as weight control (Allison et al., 2005). Generally, findings on physical activity in young people reveal that younger adolescents, boys and adolescents from highly affluent families tend to meet physical activity recommendations, but other groups only to a limited degree (Nader et al., 2008; Kalman et al., 2015a; Inchley et al., 2016; Kopcakova et al., 2017).

Appropriate guidelines for physical activity at the population level, for example, in terms of intensity and duration, have been widely debated in recent years. Based on the existing evidence, the WHO recommends (WHO, 2010; WHO, 2016) firstly that children and young people should participate in at least 60 minutes of moderate- to vigorous-intensity physical activity every day. Secondly, WHO states that amounts of physical activity greater than 60 minutes is likely to provide additional health benefits.

## 1.3 Screen-based activities in adolescents

Adolescents spend most of their time sitting during the school day. Sitting and being quiet is often seen as a desired behaviour. In leisure time, sitting and consuming screen-based activities (e.g., watching TV, surfing the internet) is also very common (Bucksch et al., 2016), though not a particularly desired behaviour.

Sedentary behaviour is a complex behaviour, and according to Tremblay et al. (2011), it represents "a distinct class of behaviours (e.g. sitting, watching TV) characterised by little physical movement and low energy expenditure". Similar to physical activity that can be classified by type, context, location, frequency, duration and intensity, being sedentary also has a multi-dimensional nature (Bucksch et al., 2016; Cui et al., 2011). In general, sedentary behaviour can be subdivided into screen-based activities (e.g. watching TV, playing computer games, working with computer) and non-screen-based activities (e.g. motorised transport, social activities, personal care) (Pate et al., 2011). Studies that identify sedentary behaviour as risk behaviour from a public health perspective

highlight the need to examine sedentary behaviours in more detail and to address their health consequences (e.g. Biswas et al. 2015).

Growing evidence suggests that screen-based activities are associated with a range of negative health outcomes (e.g. an important risk factor for physical, psychological and socio-emotional health), independent of physical activity (Carson et al., 2016). These include an increased risk of cardio-metabolic disease, all-cause mortality, and a range of physiological and psychological conditions in adults (de Rezende et al., 2014; Biswas et al., 2015). Generally, findings on screen-based activities in young people reveal that older adolescents and adolescents from lowly affluent families tend to do more excessive screen-based activities (Bucksch et al., 2016; Stierlin et al., 2015; Christian et al., 2015; Kopcakova et al., 2017). Gender patterns for the use of some screen-based activities differ, with girls tending to use computers for social purposes and boys for gaming (Inchley et al., 2016).

Based on the current evidence guidelines regarding screen-based activities refer mostly to reducing these activities and further sedentary activities to no more than two hours in leisure time per day (Trembley et al., 2011). A more recent approach takes into account the interplay and interaction between light and moderate physical activity, sedentary behaviour and sleep. It proposes a 24-movement guideline which integrates all behaviours instead of separating them into different isolated recommendations (Trembley et al., 2011; Chaput & Dutil, 2016).

## 1.4 Physical activity and screen-based activities in the context of a socio-ecological approach during adolescence

Both physical activity and screen-based activities have an important impact on youth development (Currie et al., 2012; Badura et al., 2015; Inchley et al., 2016). Higher levels of physical activity and lower levels of screen-based activities are of major importance for the development of youth and for their physical, psychological and socio-emotional health. This also underlines the need for a better understanding of the determinants of daily physical activity and screen-based activities among children and adolescents. Better understanding of this might be a prerequisite to develop from healthy adolescents into healthy adults. Figure 1.1 represents the conceptualisation of sedentary behaviour relative to active behaviours in terms of energy expenditure (British Heart Foundation National Centre for Physical Activity and Health, 2012). Energy expenditure is the amount of energy or calories that a person needs to carry out a physical function, such as breathing, circulating blood, digesting food, or physical movement. To prevent weight gain, energy intake or calorie intake must be balanced with energy expenditure. For example, regular physical activity increases energy expenditure, which can help control normal weight.

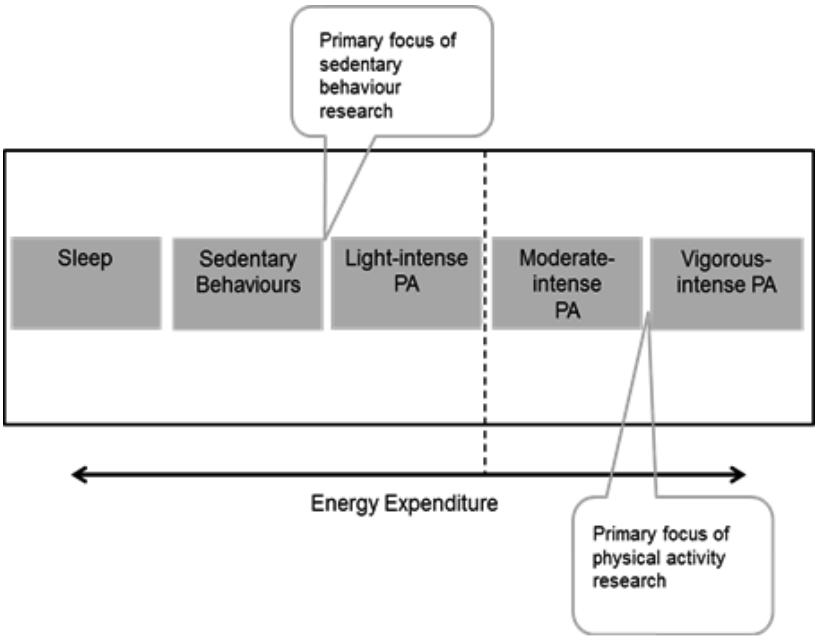



**Figure 1.1 Conceptualisation of sedentary behaviours and physical activity (British Heart Foundation National Centre for Physical Activity and Health, 2012)**

Next, it might be inferred that more screen-time activities lead to less physical activity; however, screen-time activities and physical activity have been shown to be independent constructs regarding time spent on them, and various studies have highlighted the relative independence of these two behaviours (Mansoubi et al., 2014; Pearson et al., 2014). Young people do not always fall into one group or the other; accordingly it is possible to be highly sedentary and at the same time to meet current physical activity guidelines and vice versa (Pearson et al., 2014). An explanation for this may be that the increase in screen-based activities could, generally, be considered as being at least partially a result of the development of new technologies surrounding adolescents in everyday life.

Both, physical activity and screen-based activities of adolescents could be explained for the purpose of this study in terms of a socio-ecological approach. According to ecological models, higher levels of physical activity and lower levels of screen-based activities are expected when environments and policies support physical activity, when social norms and social support for engagement in physical activity are strong, and when individuals are motivated and educated to be active (Sallis et al., 2006). Currently, ecological models are frequently used to gain insight into the factors that determine physical activity levels and

sedentary behaviour. Both physical activity and screen-based activities of adolescents can be explained in terms of a socio-ecological approach (Sallis et al., 2008), and the research included in this thesis can be fully framed by this model. Therefore, Figure 1.2 represents the ecological model of active living (Sallis et al., 2006) as adolescent´s interaction with their physical and socio-cultural surroundings. For the purpose of this thesis determinants of physical activity and screen-based activities will be discussed as the associations of these behaviours with intrapersonal level, perceived environment and environmental setting of behaviour.

**Figure 1.2 Ecological model of active living (Sallis et al., 2006- modified)**

### 1.4.1 Determinants of physical activity in adolescents

An overview of potential determinants of physical activity at different levels of influence is given in a review of Bauman et al. (2012). Key determinants include demographic factors (younger age, male), psychological factors (such as perceived competence, self-efficacy), social and cultural factors (such as social support for physical activity from parents and peers) and the physical environment (such as walkability, proximity to recreation facilities) (Bauman et al., 2012).

In general, two approaches have been identified to seek determinants of physical activity behaviour (Biddle & Nigg, 2000). The first approach focuses on a variety of motivational theories, including the Social Cognitive Theory, the Theory of Planned Behaviour, or the Self-Determination Theory (Biddle & Nigg, 2000; McKenna & Riddoch, 2005). These theories assume complex cognitive processes, including self-evaluation, goal setting and planning. The key constructs include self-efficacy, outcome expectations, perceived social norms, behavioural attitudes, perceived behavioural control, perceived competence and autonomy. The second approach is a more descriptive or empirical approach and mostly identifies the correlations between potential determinants of physical activity and physical activity behaviour itself. Since a long list of potential determinants from very different levels of influence has been identified in recent decades, these potential determinants have highlighted the significance of a socio-ecological approach to explain physical activity behaviour in a comprehensive framework (Bauman et al., 2012; Ward et al. 2007). In addition to the already mentioned approach, the socio-ecological approach frames the interplay between the social and physical environment-, and individual characteristics (Sallis et al., 2006; Sallis et al., 2008). In this section the associations of physical activity with the intrapersonal level, perceived environment and environmental setting of behaviour are discussed.

*Intrapersonal level*

Firstly, the intrapersonal level in the ecological model of active living (Sallis et al., 2006) among adolescents is discussed. One of its constructs is body image. Body image is a multidimensional construct with attitudinal, perceptual and also behavioural components (Verplanken et al., 2008) covering various attributes like muscularity, leanness and body weight. We pay special attention to dissatisfaction with body weight as a component of body image, as it has a particular importance due to its association with subjective well-being (Verplanken et al., 2008; Meland et al., 2007) and weight-control behaviour, which may manifest itself in both unhealthy (e.g., fasting, purging, smoking and extreme diets or training) and healthy (e.g., healthy diet, appropriate physical activity) lifestyles

(Inchley et al., 2016). Body-weight satisfaction may change remarkably during adolescence (especially in puberty) due to rapid and significant somatic changes and may then have an impact on mental well-being and behaviour (Currie et al., 2012; Inchley et al., 2016). Most of the available evidence shows that a more developed pubertal status is associated with a less positive body image, increased body dissatisfaction and increased internalization of thin ideals (Slater & Tiggemann, 2011; Currie et al., 2012).

Dissatisfaction with body weight on average intensifies across adolescence among girls while remaining constant among boys (Curie et al., 2012). Dissatisfaction with body weight seems to be associated with a negative body image (Currie et al., 2014), and gender might modify its effect. The international Health Behaviour in School-Aged Children (HBSC) study has shown that gender-specific patterns on body image exist, consistent with other studies (Currie et al., 2012; Konstanski et al., 2004; Austin et al., 2009), i.e. that girls have a significantly higher prevalence in perceiving their body as being too fat compared with boys. On the other hand, the pathway to boys' body dissatisfaction might go through an internalised commitment to muscularity (Rodgers et al., 2012) and might be related to both underweight and overweight/obesity. According to the findings of Currie et al. (2012), boys and girls in Western and Central Europe are more likely to report being "too fat" than boys and girls in Eastern Europe.

Moreover, motivation has already been shown to be a personal characteristic that may be one of the key factors for understanding why some people are physically active in their leisure time (Aaltonen et al., 2014). Motivation as a central point of the Self-Determination Theory is mostly explored in terms of intrinsic versus extrinsic motivation. Intrinsic motivation is completely self-determined and is reflected in behaviour performed for the pleasure in and stimulation by the activity itself (Ryan, Deci, 2000). More intrinsic, self-determined forms of motivation are associated with optimal functioning and well-being (Ryan, Deci, 2000). Regarding physical activity, adolescents who were intrinsically motivated were more likely to be physically active (Power et al., 2011). The Goal Contents Theory, a theory belonging to the Self-Determination Theory field, does not only distinguish between intrinsic and extrinsic goals and their impact on motivation and wellness. The Goal Contents Theory more specifically outlines extrinsic goals, such as financial success, appearance and popularity/fame, contrasting these with intrinsic goals, such as community, close relationships and personal growth, with the former more likely to be associated with lower wellness and greater ill-being (Ryan, Deci, 2000; Deci, Ryan, 1985). As suggested by several studies, one of the potential pathways leading to an increase in levels of physical activity is through their associations with particular motives for physical

activity (e.g. Nigg, 2003; Kopcakova et al, 2015; Iannotti et al., 2013; Wold et al., 2015). A better understanding of motives for being physically active or inactive could significantly contribute to evidence-based development of national strategies for public health and active living (Kopcakova et al, 2015; Kalman et al., 2015b; Jodkowska et al., 2015) and may increase the effects of interventions.

*Perceived environment*

Next, we discuss perceived environment as a part of the ecological model among adolescents. Adolescents' perceptions of environments are distinguished from more objective aspects of environments, and intrapersonal level together with perceived environment are likely to be important influences on active living (Sallis et al., 2006). Besides determining the environment objectively, it is also possible to determine the neighbourhood environment subjectively. The subjectively perceived environment of children as well as the perceptions of parents is most frequently used in research investigating the physical environment. An environment perceived as activity-friendly may affect physical activity, but the mechanism is not clear. Recent evidence from an international cross-sectional study among adults suggests that a physical activity-friendly environment may be important for the promotion of physical activity (Sallis et al., 2016). However, studies among adolescents within a European context are scarce (Ding et al., 2011; Ommundsen et al., 2008). To our knowledge, one exception is a study of Bucksch et al. (submitted) among adolescents from four European countries, which found consistent findings on perceived environment and physical activity among boys and girls. It highlights the importance for children of having others at home or nearby to play with and be active.

*The environmental setting of behaviour*

Last but not least, we discuss in this section the environmental setting of behaviour as part of the ecological model among adolescents. The environmental setting of behaviour is the place where physical activity of adolescents may occur, and it is useful to consider both access to settings and their specific characteristics. To understand the influences on adolescent's activity patterns it might be helpful to first understand the influence of the built environment, such as the level of roads, parks, public transport, housing etc. which can have a positive or negative affect depending on design or location. In this chapter the accessibility of different sports facilities at school, active breaks at school and degree of urbanization need to be discussed. The HBSC study has shown that the physical environmental characteristics of schools (i.e. facilities for physical activity) relate to students' daily physical activity at school (Haug et al., 2008; Haug et al., 2010). Some of the school environmental effects may

in fact be due to the socio-economic position of individuals (Rydin et al., 2012). A review of Ding et al. (2011) found that the most consistent associations were found between objectively measured environmental attributes and self-reported physical activity.

### 1.4.2 Determinants of screen-based activities in adolescents

It is important to note that the determinants of physical activity and sedentary behaviour differ and might have an opposite meaning for one or the other behaviour (Van der Horst et al., 2007). Increasing evidence suggests that screen-based activities are associated with a range of negative health outcomes, independent of physical activity (de Rezende et al., 2014; Biswas et al., 2015). However, the quality of the studies in this area is limited, and only a few prospective studies exist, since most studies only focus on TV watching. Drawing on a number of different reviews, the following correlates might be promising to focus on in interventions in adolescence (Pate et al., 2011; Salmon et al., 2011; Stierlin et al., 2015): psycho-social, social and environmental (e.g. Brindova et al., 2014; Brindova et al., 2015; Sigmundova et al., 2014a; Kopcakova et al., under review). In addition, most knowledge is on sociodemographic (e.g. sex or age) correlates that cannot be modified (Kopcakova et al., under review; Stierlin et al., 2015).

In addition, regarding screen-based activities an overview of potential determinants at different levels of influence is given in a review of Chastin et al. (2016). Their study also shows a new framework, called systems of sedentary behaviours, which is based on a socio-ecological approach. From a theoretical point of view sedentary behaviour can only be explained by determinants from different levels of influence within a socio-ecological approach (Chastin et al., 2016) and is currently applied to the area of sedentariness in adults (Owen et al., 2010) as well as in children and adolescents (Salmon et al., 2011). In this section we discuss the associations of screen-based activities with the adolescents' perceived environment and the environmental setting of behaviour.

*Perceived environment*

An environment perceived as activity-friendly may affect screen-based activities in both a positive and a negative way. Most studies to date have focused on demographic and behavioural variables (Stierlin et al. 2015; Chastin et al. 2016). Findings indicate that correlates of the social and physical environment, such as having rules for restricting TV use (Bjelland et al. 2015) or a physical activity-friendly neighbourhood, are associated with reduced screen-time activities (Veitch et al. 2011). Also, a study of Bucksch et al. (submitted) from Central European countries found that if girls and boys have to tell their parents where they are when they go out and play, they are more likely to report lower screen-

time activities. Moreover, it was found that high involvement in screen-based activities, particularly working with a computer, was associated with health complaints among adolescents, and these associations were not moderated by physical activity (Brindova et al., 2015). In addition, the social environment seems to play an important role for adolescent´s screen-time activities by providing a social network and social support (Sawka et al. 2013; Macdonald-Wallis et al. 2012; Stierlin et al. 2015). Interestingly, most evidence is derived from individual countries not from Central Europe (Ommundsen et al., 2008) or outside Europe, such as the USA and Australia (Ding et al. 2011; Stierlin et al. 2015).

*The environmental setting of behaviour*

In this section we will discuss the environmental setting of behaviour, such as the school environment, active breaks and degree of urbanization, as determinants of screen-based activities in adolescents. As adolescents spend a considerable portion of their day at school, school institutional factors may be important determinants of students' health and health behaviour (Spence & Lee, 2003). This may, for instance, be due to the physical environment a school offers and the social environment, with various social connections between students (King et al., 2002). In a recent review, Stierlin et al. (2015) found that for most environmental settings of behaviour and screen-based activities there is no evidence or inconsistent evidence for an association. However, some of the school environmental effects may in fact be due to the socio-economic position of adolescents (Rydin et al., 2012). Adolescents who live in lower socio-economic neighbourhoods are spending more time with screen-based activities (Brodersen et al., 2007).

## 1.5 Aim of the study and research questions

The general aim of this thesis is to examine the relationships of adolescents' physical activity and screen-based activities and the associations of these behaviours with potential determinants (e.g. body image, motives to physical activity, school environment, degree of urbanization, perceived activity-friendly environment). Additionally, this thesis explores the role of gender, age and socioeconomic differences in these associations.

Figure 1.3 presents the model of the relationships as examined within this thesis.

Five main research questions were formulated based on the previously stated aims.

**Research question 1:**

Do associations of body image and gender with physical activity exist? (Chapter 3)

**Research question 2:**
Is there an association between motives for physical activity and the level of physical activity among adolescent boys and girls? (Chapter 4)

**Research question 3:**
Are the motives for undertaking physical activity items from the HBSC questionnaire reliable among adolescents and does this reliability differ by gender, age group and country? (Chapter 5)

**Research question 4:**
Are the accessibility of sports facilities at school, active recess and degree of urbanization of the living area supportive for being more physically active and engaging less in screen-based activities among adolescents? (Chapter 6)

**Research question 5:**
Is a perceived activity-friendly environment associated with adolescent´s behaviour in terms of physical activity and screen-based activities? (Chapter 7)

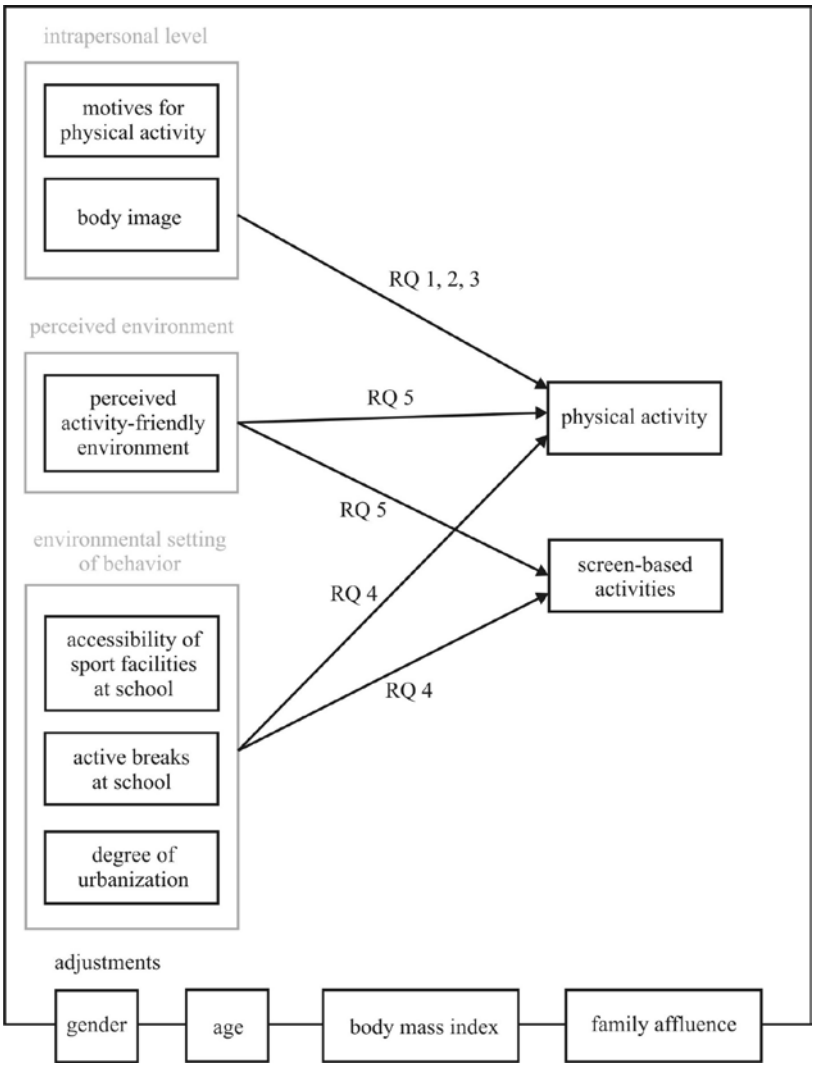



**Figure 1.3 Model of the relationships examined in the thesis.**

## 1.6 Outline of the thesis

**Chapter 1** provides general information and the scientific background on the key theoretical constructs of this thesis – physical activity, screen-based behaviour – and the associations of these behaviours with their determinants. The aim of the study as well as the research questions are formulated in this chapter.

**Chapter 2** provides the description of the five research samples used in this thesis. It also provides information on the design of the study, measures and statistical analyses.

**Chapter 3** focuses on the association of body image with physical activity of adolescents, and on whether gender modifies these associations.

**Chapter 4** explores the connection between the motives for physical activity and the level of physical activity in adolescence and potential gender-related differences regarding this connection.

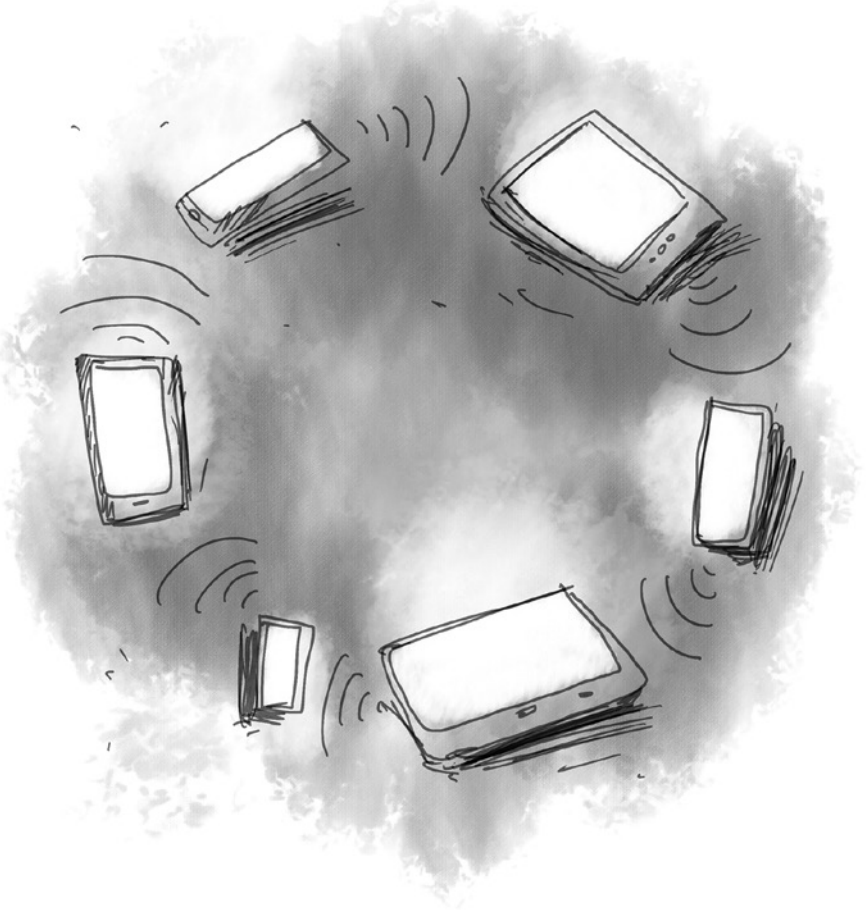
**Chapter 5** investigates the test-retest reliability of the motives for undertaking physical activity items from the HBSC questionnaire among adolescents, and whether this reliability differs by gender, age group and country.

**Chapter 6** assesses whether the accessibility of sports facilities at school, active breaks and degree of urbanization are associated with physical activity and screen-based activities among adolescents and whether these associations are modified by degree of urbanization.

**Chapter 7** explores the association of the perception of activity-friendliness of the environment with physical activity and screen-based activities among adolescents.

**Chapter 8** summarises and discusses the main findings of this thesis. It also explores the strengths and limitations of the study and the study's implications for practice and policy, as well as further research.

# 2 | Data sources



Chapter 2

# Data sources

This chapter provides a description of the study samples (2.1), measures (2.2) and statistical analyses (2.3) used in this thesis.

## 2.1 Study samples and procedures

This thesis is based on five different samples from two surveys (conducted in 2010 and 2014) and a pilot study (conducted in 2013) of the Health Behaviour in School-aged Children (HBSC) study. Sample 1, from 2010 (used in Chapter 3), and sample 2, from 2014 (used in Chapter 6) are from two surveys of the HBSC study conducted in Slovakia. The designs of the studies were approved by the Ethics Committee of the Medical Faculty of Pavol Jozef Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation in it. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation. Questionnaires were administered by trained research assistants in the absence of a teacher during regular class time.

To obtain a representative sample, we used a two-step sampling. In the first step, larger and smaller elementary schools located in rural as well as urban areas from all regions of Slovakia were asked to participate. These were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education (N=134 in 2010, N=151 in 2014). Grammar and elementary schools, including church schools and schools with the Hungarian language, were included in the study samples. The school response rates were 98.1% in 2010 and 86.1% in 2014, respectively. In the second step, we obtained data from a representative sample of adolescents from the fifth to ninth grades of elementary schools in Slovakia in the target group of 11- to 15-year-olds (N=8,491 in 2010 and N=10,179 in 2014). Non-responses were caused mainly by school absence due to illness or other reasons and the refusal of parents or adolescent to be involved in the study.

The third study sample was used from the HBSC study conducted in 2010 in Slovakia, described above, and that in the Czech Republic in the same year. For the Czech Republic, from a list of schools based on information from the Institute for Information on Education, a contributory organization of the Ministry of Education, Youth and Sport, 91 schools from all 14 regions of the Czech Republic were randomly

chosen to create a representative sample. We contacted 91 schools, and 86 schools took part in our survey (school response rate: 94.5%). According to the protocol of the HBSC study, classes from the 5th to 9th grades were selected randomly, one from each grade per school. Grammar and elementary schools were included in the Czech study sample. We obtained data from 5284 adolescents from the 5th, 7th and 9th grades of elementary schools in the Czech Republic (response rate: 87.0%). According to Czech legislation the study did not have to be approved by an Ethics Committee, because the study consisted of an anonymous questionnaire. However, we adhered to current ethics standards per the Declaration of Helsinki. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation in the study. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation. Questionnaires were administered by trained research assistants in the absence of a teacher during regular class time.

The fourth study sample was based on the international HBSC study and is consistent with its methodology. This test-retest study was conducted in the Czech Republic and Slovakia in 2013. It was preceded by a pilot study which included the administration of questionnaires and the use of focus groups in both countries. Based on the data obtained in the pilot study, the final set of questions was compiled. We contacted 12 larger and smaller primary schools located in rural as well as in urban areas in the Olomouc region, Czech Republic (seven schools), and the Kosice region, Slovakia (five schools). The prevalence rates regarding the explored variables in the recruited samples were rather similar to those in other studies covering all regions, so we anticipate that our findings in both the Czech and Slovak Republics can be generalized to a wider population.

The schools were randomly chosen to create a representative sample. We succeeded in achieving a 100% response rate on the school level, since all of the contacted schools agreed to participate. Questionnaires were administered in the 5th and 9th grades by trained research assistants in the absence of a teacher during regular class time. In the first part of the data collection (Test) we obtained data from 419 adolescents in the Czech Republic (response rate: 83.20%) and 259 adolescents in Slovakia (response rate: 74.1%). Non-response was primarily due to illness and parental disapproval of the participation of their children. The second part of the data collection (Retest) was conducted 4 weeks after the first part. We obtained data from 353 adolescents in the Czech Republic (66 dropped out, 15.7%) and 227 adolescents in Slovakia (32 dropped out, 12.3%) who also participated in the first part of the data collection (Test). The final sample consisted of 353 Czech (51.9% boys) and 227 Slovak (52.9% boys) primary school pupils, grades five and nine. The

study was approved by the Ethics Committee of the Faculty of Physical Culture, Palacky University in Olomouc, and by the Ethics Committee of the Medical Faculty at P J Safarik University in Kosice. The schools in the Czech Republic had a general permission granted at the beginning of the school year by all parents. Parents in Slovakia were informed about the study via the school administration and could opt out if they disagreed with it. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation in either country.

Our fifth and last study sample was based on the international HBSC study and presents data from 13- to 16-year-old school children from the latest survey wave in 2014. Four countries (Czech Republic, Germany, Poland and Slovakia) were included. Each of the country-specific samples was based on a nationally representative randomized cluster (i.e. school level) sampling procedure. The study samples included grammar and elementary schools in Czech Republic; grammar schools, intermediate modern secondary schools and modern secondary schools in Germany; public elementary schools in Poland and grammar and elementary schools, including church schools and schools with Hungarian language, in Slovakia. In total 13,800 students were recruited. Surveys were administered by class teachers and trained research assistants during regular class time; participation was voluntary, and confidentiality of the participants was ensured. Response rates varied per country (89.2% in the Czech Republic, 72.5% in Germany, 86.1% in Poland and 78.8% in Slovakia). Non-response was mainly due to illness (Czech Republic, Poland and Slovakia), parental disapproval of the participation of their children (Germany, Poland and Slovakia) and children's disapproval of participation in the study (Czech Republic). The studies were approved in the Czech Republic by the Ethics Committee of the Faculty of Physical Culture, Palacky University Olomouc; in Germany by the Ethics Committee of the University Hospital Hamburg; in Poland by the Bioethics Committee at the Institute of Mother and Child; and in Slovakia by the Ethics Committee of the Medical Faculty at the P. J. Safarik University in Kosice. Table 2.1 below indicates which sample was used in which chapter.

**Table 2.1 Basic characteristics of the research samples**

| Sample | Chapter(s) | Countries | Year of data collection | National representativeness | Origin of the data (area) |
|---|---|---|---|---|---|
| 1 | 3 | Slovakia | 2010 | yes | schools across Slovakia |
| 2 | 6,7 | Slovakia | 2014 | yes | schools across Slovakia |
| 3 | 3,4 | Slovakia, Czech Republic | 2010 | yes | schools across Slovakia and the Czech Republic |
| 4 | 5 | Slovakia, Czech Republic | 2013 | no | schools in Kosice (Slovakia) and Olomouc (Czech Republic) region |
| 5 | 7 | Slovakia, Czech Republic, Poland, Germany | 2014 | yes | Schools across Slovakia, the Czech Republic, Poland and Germany |

## 2.2 Measures

This section provides an overview of the variables used in this thesis. Table 2.2 provides brief information on the origin of the measures and a short description of them.

**Table 2.2 Overview of the central variables used in this thesis**

| Measure | Source | Role in analyses | Chapters | Short description |
|---|---|---|---|---|
| Physical activity | HBSC 2010, 2014 | Dependent | 3,4,6,7 | Indicator of positive health behaviour |
| Body image | HBSC 2010 | Independent | 3 | Indicator of negative self-image |
| Body Mass Index | HBSC 2010 | Confounder | 3 | Indicator of weight |
| Motives for physical activity | HBSC 2010 | Independent | 4,5 | Indicator of exercise motivation |
| Screen-based activities | HBSC 2014 | Dependent | 6,7 | Indicator of health behaviour |
| Degree of urbanization | HBSC 2014 | Independent | 6 | Indicator of built environment |
| Active breaks (active recess) | HBSC 2014 | Independent | 6 | Indicator of school health policy |
| Accessibility of sports facilities at school | HBSC 2014 | Independent | 6 | Indicator of school environment |
| Family affluence | HBSC 2014 | Confounder | 7 | Indicator of socioeconomic status |
| Perceived environment | HBSC 2014 | Independent | 7 | Indicator of perceived social and physical environment |

## 2.3 Statistical analyses

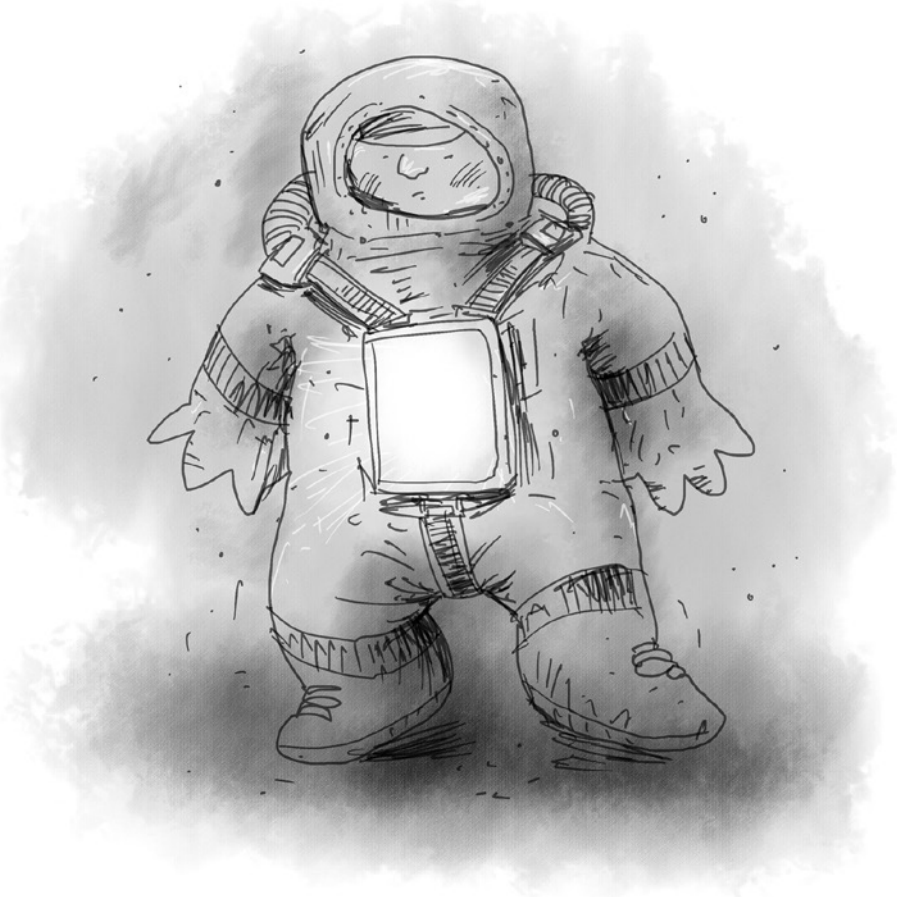
Several statistical methods were used across the study. Analyses were performed using the statistical software packages SPSS and STATA software. Each chapter provides detailed information about the performed statistical analyses. In general, we first described the frequencies and simple prevalence rates of the concerned behaviour. Next, to answer the research questions of each sub-study, the associations between independent and dependent variables were computed using logistic regression models and multilevel logistic regression, crude and adjusted for potential confounders. Moreover, for the purpose of this thesis we used also Intraclass Correlation Coefficients to assess the multilevel structure of data. Finally, to explore the differences between dichotomous

independent variables we used the chi-square test, and for continuous variables we used the t-test.

# 3

## Is being a boy and feeling fat a barrier for physical activity?

## The association between body image, gender and physical activity among adolescents



Chapter 3

# Is being a boy and feeling fat a barrier for physical activity? The association between body image, gender and physical activity among adolescents

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## Abstract

Regular physical activity leads to physical and mental health benefits. Previous studies have shown physical activity to be associated with body image and gender. The aim of this cross-sectional study was to explore the associations of body image with physical activity of adolescents and whether gender modifies this association. We obtained data on body image and physical activity as part of the Health Behaviour in School-Aged Children study in 2010 from Slovakia (n = 8042, age 11–15 years, 49% boys, response rate: 79.5%). Adolescents answered questions about their body image and the frequency of their physical activity. Sufficient physical activity was less likely in adolescents perceiving themselves as fat (OR = 0.63, 95%CI 0.54–0.73) and in boys (OR = 2.15, 95%CI 1.92–2.42). A poor body image among girls was not associated with physical activity, whereas among boys it was associated with less physical activity. Gender seems to moderate the relationship between body image and physical activity in youths. Health promotion should be targeted in particular at boys with a negative body image, as they are at higher risk of physical inactivity.

**Keywords:** adolescents; body image; physical activity; gender

## Introduction

Physical activity is an essential part of a healthy lifestyle in adolescence (Hallal et al., 2006). Regular physical activity leads to physical and mental health benefits, which can make an important contribution to improving physical and psychological quality of life (Penedo, Dahn, 2005). Low levels of physical activity during adolescence contribute to obesity and poor health outcomes in adulthood (Penedo, Dahn, 2005; Strong et al., 2005), and this association endures into adulthood (Riddoch et al., 2004). Physical activity is linked with a number of positive physical and psychological health outcomes (Hallal et al., 2006; Strong et al., 2005; Iannotti et al., 2009). Generally, findings on physical activity in young people reveal that boys are more active than girls, and that the amount of physical activity decreases with age (Riddoch et al., 2004; Currie et al., 2004, Currie et al., 2008; Dumith et al., 2011; Slater, Tiggemann, 2011; Nader et al., 2008; Nelson, Gordon-Larsen, 2006; Haug et al., 2009).

Body image is a multidimensional construct with attitudinal, perceptual and also behavioural components (Verplanken, Velsvick, 2008) covering various attributes like muscularity, leanness and body weight. The present study pays special attention to dissatisfaction with body weight as a component of body image, as it has particular importance due to its association with subjective well-being (Verplanken, Velsvick, 2008; Meland et al., 2007) and weight-control behaviour, which may manifest itself in both unhealthy (e.g., fasting, purging, smoking, extreme diets or training) and healthy (e.g., healthy diet, appropriate physical activity) lifestyles (Currie et al., 2008). Body weight satisfaction may change remarkably during adolescence (especially in puberty) due to rapid and significant somatic changes, and may then have impact on mental well-being and behaviour (Currie et al., 2014). Most of the available evidence shows that a more developed pubertal status is associated with a less positive body image, increased body dissatisfaction and increased internalization of thin ideals (Currie et al., 2004; Currie et al., 2008; Slater, Tiggemann, 2011). Dissatisfaction with body weight intensifies across adolescence among girls while remaining constant among boys (Currie et al., 2012). Dissatisfaction with body weight seems to be associated with a negative body image (Currie et al., 2014), and gender might modify its effect. International Health Behaviour in School-Aged Children study (HBSC) data on body image have shown consistent patterns with other studies (Currie et al., 2004; Currie et al., 2008; Currie et al., 2012; Konstanski et al., 2004; Austin et al., 2009) that girls have a significantly higher prevalence in perceiving their body as being too fat compared with boys. On the other hand, the pathway to boys' body dissatisfaction might go through an internalised commitment to muscularity (Rodgers et al., 2012) and might be related to both underweight and overweight/obese.

According to the findings of Currie et al. (2012), boys and girls in Western and Central Europe are more likely to report being "too fat" than boys and girls in Eastern Europe.

Several studies have shown that regular physical activity has a beneficial effect on body image perception among children and adolescents. Body image dissatisfaction may be the reason for choosing physical activity and exercise as a strategy for obtaining the optimal image, especially in adolescent girls (McCabe, Ricciardelli, 2004; Smith et al., 1998), and inversely, body image dissatisfaction was also related with less engagement in physical activities (Jensen, Steele, 2009). Regardless, the association between body image dissatisfaction and physical activity has not yet been properly quantified, as previous research was carried out only among specific gender or age subgroups (Burgess et al., 2006; Kircaldy et al., 2002; Standford, McCabe, 2005).

Gender seems to play an important role in the connection between body image and physical activity. The association between gender and physical activity was explored in the above-mentioned studies (Riddoch et al., 2004; Iannotti et al., 2009; Currie et al., 2004; Currie et al., 2008; Slater, Tiggemann, 2011), and many other studies have unequivocally documented differences in girls' body image dissatisfaction to be associated with physical activity (Monteiro Gaspar et al., 2011; Penas-Lledo et al., 2002; Gillison et al., 2009). According to our knowledge, the possible effect of boys' body image dissatisfaction associated with physical activity has also not yet been studied, and this is also of foremost interest. Through this study, we want to explore and clarify the associations of body image and gender with physical activity.

The aim of this study was to explore the associations of body image with physical activity controlled for age, and whether this association is modified by gender crude and after additional adjustment for BMI.

## Methods

*Sample and Procedure*

We used data from the Health Behaviour in School-aged Children (HBSC) cross-sectional study conducted in 2010 in Slovakia. From a list of schools based on information from the Slovak Institute of Information and Prognosis for Education, 134 larger and smaller schools located in rural as well as in urban areas from all regions of Slovakia were randomly chosen to create a representative sample. We contacted 108 schools, and 106 schools took part in our survey, representing a 98.1% school response rate. According to the protocol of the HBSC study, classes from the 5th–9th grades were selected randomly, one from each grade per school. We obtained data from 8491 adolescents 10–19 years of age (mean age 13.12 years, 48.7% boys) from the 5th–9th grade of elementary schools in

Slovakia (response rate 79.5%). Non-response was primarily due to illness (10.3%) and parental disapproval of the participation of their children (7.4%). We decided to exclude children under age 11 and over 15 to make the sample more homogeneous and to avoid the influence of age extremes. After this step, the study sample consisted of 8042 adolescents (mean age 13.13 years, 48.6% boys) from elementary schools in Slovakia.

The study was approved by the Ethics Committee of the Faculty of Medicine at the Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with participation. Participation in the study was fully voluntary and anonymous with no explicit incentives provided for participation. Questionnaires were administrated by trained research assistants in the absence of a teacher during regular class time.

*Measures*

Demographic data (age, gender) were collected using questions used and validated in the Health Behaviour in School-Aged Children (HBSC) surveys (Currie et al., 2004; Currie et al., 2008; Roberts et al., 2007).

Body image was assessed using the single-item HBSC question asking "Do you think your body is?" with five possible answers ranging from "much too fat" to "much too thin" (Currie et al., 2004; Currie et al., 2008). We dichotomised the answers into two categories—those who felt fat (answers "a bit too fat" and "much too fat") and those who felt not fat (answers "much too thin", "a bit too thin" and "about the right size").

Physical activity was assessed by the single-item HBSC question asking "Over the past 7 days, on how many days were you physically active for a total of at least 60 min per day?" with answers ranging from 0–7 days (Currie et al., 2004; Currie et al., 2008). This item was developed by Prochaska et al. (2001) to produce a reliable and valid screening measure of moderate to vigorous physical activity of children and adolescents. To assure that respondents will consider the whole variety of physical activity and will take into account intensity, the item is associated with the following introductory instruction: "Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, school activities, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball or skiing." The responses to this question were dichotomised for logistic regression into two categories, with the cut-off point at 7 days of physical activity, further denoted as sufficient (7 days) *vs.* not sufficient physical activity (0–6 days) (Strong et al., 2005).

Body Mass Index was calculated from the item HBSC questions asking "How much do you weigh with no clothes on?" and "How tall are you with no clothes on?" (Currie et al., 2004; Currie et al., 2008). The

responses to this question were used as a continuous variable.

*Statistical Analyses*

Standard descriptive analyses for the whole study sample as well as for genders were performed in the first step. Next, we explored the prevalence of age, physical activity, body image and body mass index by gender and examined gender differences using chi-square tests to determine statistical significance. In the third step, we used binary logistic regression models adjusted for age to explore the associations of body image with sufficient physical activity, leading to odds ratios (OR) and 95% confidence intervals (CI). In Model 1, we explored the association of body image and gender with physical activity. In Model 2, the interaction between body image and gender was added in order to assess the moderating effect of gender on the association between body image and physical activity. In Model 3, we repeated the analyses and in addition to age we adjusted the analyses also for BMI status. All analyses were performed using the Predictive Analytics Software, Version 18.0 (PASW, Chicago, IL, USA).

## Results

The background characteristics of the sample are present in Table 1, overall and by gender. Statistically significant gender differences were found for all studied variables. Boys reported more physical activity on 7 days/week, higher satisfaction with their body image and higher BMI compared with girls.

Table 2 presents the odds ratios (OR) and 95% confidence intervals (CI) from the logistic regression analyses. In Model 1, significant associations were found between body image and physical activity as well as between gender and physical activity. In Model 2, we found a significant interaction between body image and gender. This showed that poor body image did not affect the physical activity of girls, whereas poor body image was associated with lower probability to reach recommended level of moderate to vigorous physical activity of boys. Next, in Model 3 we adjusted for age and BMI status. This did not change the association between the explored variables to a substantial degree.

**Table 1. Descriptive statistics for age, physical activity, body image and body mass index, for the whole sample and separately for boys and girls.**

| | Whole Sample ($n$ = 8042) | Boys ($n$ = 3910) | Girls ($n$ = 4132) | $p$ |
|---|---|---|---|---|
| Age: Mean (SD) | 13.13 (1.35) | 13.16 (1.35) | 13.11 (1.35) | <0.001 [a] |
| Physical activity: $n$ (%) | | | | <0.001 [b] |
| sufficient | 1765 (22.5) | 1116 (29.3) | 649 (16.1) | |
| not sufficient | 6089 (77.5) | 2696 (70.7) | 3393 (83.9) | |
| Body image: $n$ (%) | | | | <0.001 [b] |
| fat | 1901 (23.9) | 766 (19.9) | 1135 (27.6) | |
| not fat | 6059 (76.1) | 3083 (80.1) | 2976 (72.4) | |
| BMI: Mean (SD) | 19.34 (3.19) | 19.75 (3.33) | 18.96 (2.99) | <0.001 [a] |

Notes: Number of missing cases per variable: Age—0; physical activity—188; body image—82; BMI—822; BMI, Body mass index; SD, standard deviation; [a] $t$-test; [b] Chi-square test.

**Table 2. Associations of body image and gender with sufficient physical activity: Odds ratios (OR) and 95% confidence intervals (95% CI) from binary logistic regression adjusted for age and BMI status.**

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| | OR (95%CI) Adjusted for Age | OR (95%CI) Adjusted for Age | OR (95%CI) Adjusted for Age and BMI Status |
| Body image | | | |
| not fat (Ref.) | 1.00 | 1.00 | 1.00 |
| fat | 0.63 (0.54–0.73) *** | 0.87 (0.71–1.07) | 0.97 (0.78–1.20) |
| Gender | | | |
| girls (Ref.) | 1.00 | 1.00 | 1.00 |
| boys | 2.15 (1.92–2.42) *** | 2.44 (2.14–2.78) *** | 2.50 (2.20–2.86) *** |
| Body image (fat) × gender (male) | | 0.53 (0.39–0.71) *** | 0.55 (0.41–0.74) *** |

Notes: *** $p < 0.001$; Ref. = reference group.

## Discussion

This study explored the associations of body image and gender with physical activity and the potential influence of gender on the association between body image and physical activity of adolescents. The results show that adolescents with a negative body image engage in regular sufficient physical activity less often than others, and that boys are more likely to report sufficient physical activity. Poor body image among girls did not affect their physical activity, whereas poor body image among boys was associated with lower probability to reach the recommended level of moderate to vigorous physical activity.

We found that boys, not girls, are prone to be physically inactive when they are dissatisfied with their body image. This gender difference in the influence of body image seems to originate from different sociocultural expectations. A study of Currie et al. (2012) reported that boys and girls in Western and Central Europe are more likely to report being "too fat" compared with boys and girls in Eastern Europe. For example, Zach et al. (2013) reported in their study that the highest percentage of active boys occurred among overweight boys and those who perceived themselves as fat. This is not in line with our findings, probably due to cultural differences. As adolescents are often dissatisfied with their body development, they tend to engage in methods to change their bodies. In general, boys want to increase their muscle mass and tone, and to decrease their fat mass and mainly choose physical activity to do so, while girls want to lose weight and mainly choose dieting or other eating-related methods to change their weight (Stanford, McCabe, 2005). One possible explanation of the differences in perception of body image could be that influence on body image is transmitted mostly by media images (McCabe, Ricciardelli, 2005), a powerful conduit for the transmission and reinforcement of cultural beliefs and values, although it may not be exclusively responsible for determining the standards for physical attractiveness. Young people are especially responsive to media messages that display perfect and ideal body shapes and are at risk of preoccupation with their physical appearance and developing a negative body image. Stanford and McCabe (2005) reported in their study that parents appear to provide the strongest and most consistent messages to young adolescent boys regarding body image.

The association between body image dissatisfaction and physical activity has not yet been properly explored in quantitative research, and there is little evidence on the association between body image and physical activity among boys. Gender seems to play an important role in the connection between body image and physical activity. Gillison et al. (2009) reported in their study that those adolescent girls who are engaged in physical activity perceive it as a sort of duty, and their motivation is

related to their physical attractiveness, health benefits and feeling good about themselves, which may be connected with the way they perceive themselves. Veselska et al. (2011) reported that in boys self-perception did not play such an important role as in girls, because their motivation for physical activity differed from girls. Boys are more engaged in group sporting activities with the aim of being part of peer relationships, which is not connected directly with the way they perceive themselves. Therefore, in future research it will be also important to take a closer look at the motivation for physical activity and possible barriers to it among adolescents, particularly among adolescent boys.

This study has several important strengths, the most important being the large and representative sample size of adolescents and the high response rate. The main limitation of our study could be that we used subjective self-reports for measuring body image, physical activity and BMI. Anonymity, confidentiality and also privacy were provided by self-administration of questionnaires in the absence of teachers; this decreased the probability of the over- or under-reporting of health-related behavior (Brener et al., 2003). Moreover, the questions on physical activity that we used have been shown to have a high validity and reliability (Brener et al., 2003). While self-reported data on psychological complaints are a rather preferred source of information, the validity and reliability of self-reported as well as measured PA or sedentary behaviour indicators are discussed heavily in literature (Bobakova et al., 2015; Biddle et al., 2011; Corder et al., 2009; Slootmaker et al., 2009; Baquet et al., 2007; Nilsson et al., 2002). Neither the self-report data nor the measured data like using accelerometer or pedometer is a gold standard for measuring physical activity, and validation studies are needed to estimate potential bias. A limitation is the cross-sectional design of our study, which makes it impossible to formulate conclusive statements about causality in our findings. Our findings therefore need to be confirmed in studies with a longitudinal design.

Based on our findings, it seems that successful promotion programmes may need to consider gender-specific strategies aiming at girls and boys separately. Adolescent boys with a negative body image are less physically active than other boys, and therefore it could be important to pay attention to this.

Future studies should also further explore the negative body image among boys and not just among girls because recently attention has mostly been paid to the association between body image dissatisfaction and physical activity among girls. Future research should preferably have a longitudinal design in order to be able to assess the causal relationship between physical activity and body image by gender.

## Conclusions

Physical activity is a possible way of enhancing health during adolescence, and the amount of physical activity is not only gender dependent, but also dependent on body image. Adolescent boys with a negative body image are less physically active than other boys. A challenge in health promotion is to maintain their relatively good perception of body image while promoting physical activity. Prevention programmes should target youth by highlighting and promoting a healthy lifestyle also for adolescent boys.

# 4 Do motives to undertake physical activity relate to physical activity in adolescent boys and girls?

Chapter 4

# Do motives to undertake physical activity relate to physical activity in adolescent boys and girls?

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## Abstract

Low levels of physical activity (PA) during adolescence contribute to obesity and poor health outcomes in adolescence, and these associations endure into adulthood. The aim of this study was to assess the associations between motives for PA and the level of PA among adolescent boys and girls. We obtained data regarding motives for PA and frequency of PA in 2010 via the Health Behavior in School-aged Children cross-sectional study in the Czech and Slovak Republics (n = 9018, mean age = 13.6, 49% boys). Respondents answered questions about their motives for PA and the frequency of their PA. Motives for PA were assessed using 13 items, which were structured in four groups. We explored the association between the motives for PA and sufficient PA using univariate and multivariate logistic regression models adjusted for age, and separately for boys and girls. "Good child" motives and Achievement motives were significantly associated with sufficient PA among both boys and girls. Health motives were associated with sufficient PA only among boys, and Social motives were associated with sufficient PA only among girls. Motives for PA were associated with the level of PA, and this association was partially gender dependent. These gender differences should be considered in interventions focusing on enhancement of PA.

**Keywords:** physical activity; motives for physical activity; adolescents; gender

## Introduction

Developing and maintaining regular physical activity (PA) during adolescence contributes to health. Regular PA leads to physical and mental health benefits, including improvement of the physical and mental quality of life (Penedo, Dahn, 2005; Hallal et al., 2006; Iannotti et al., 2009), and may also improve academic and cognitive performance (Strong et al., 2005). PA plays an important role in the establishment, enjoyment and maintenance of social relationships; it provides a direct benefit by contributing to physical appearance through increased fitness, strength and weight control (Allison et al., 2005). Low levels of PA during adolescence contribute to obesity and poor health outcomes in adolescence (Penedo, Dahn, 2005; Strong et al., 2005), and these associations endure into adulthood (Riddoch et al., 2004).

Motivation is a personal characteristic that may be one of the key factors for understanding why some people are physically active in their leisure time (Aaltonen et al., 2014). Motivation as a central point of the Self-Determination Theory (SDT) is mostly explored in terms of intrinsic *versus* extrinsic motivation. Intrinsic motivation is completely self-determined and is reflected in behavior performed for the pleasure in and stimulation of the activity itself (Ryan, Deci, 2000). More intrinsic, self-determined forms of motivation are associated with optimal functioning and well-being (Ryan, Deci, 2000). Regarding PA, adolescents who were intrinsically motivated were more likely to be physically active (Power et al., 2011). The Goal Contents Theory (GCT), a theory belonging to the SDT field, does not only distinguish between intrinsic and extrinsic goals and their impact on motivation and wellness. The GCT more specifically outlines extrinsic goals, such as financial success, appearance, and popularity/fame, contrasting these with intrinsic goals, such as community, close relationships, and personal growth, with the former more likely to be associated with lower wellness and greater ill-being (Ryan, Deci, 2000; Deci, Ryan, 1985).

From the SDT theoretical background we used GCT as the basis to cluster the motivation for PA. Regarding SDT, several validation studies have been published on the clustering of motives, e.g. Ullrich-French, Cox (2009), Van den Berghe et al. (2014), Iannotti et al. (2013), Kalman et al. (2015b). The GCT provides another framing for the clustering; some of these clusters are clearly extrinsic (e.g., achievement), but some are combination of intrinsic and extrinsic motives (e.g., social, health, "Good child" motives) (Kalman et al., 2015b).

The amount of PA and motives for PA may differ highly by gender (Aaltonen et al., 2014; Iannotti et al., 2013; Caglar et al., 2009; Verkooijen et al., 2009) and by age (Verkooijen et al., 2009). Frequently reported motives among both genders were health and enjoyment (Aaltonen et al., 2014;

Verkooijen et al., 2009; Allender et al., 2006). Friendship and competition were relatively important motives for boys, and they appeared much less important for girls (Verkooijen et al., 2009; Smith, 2003; Weis, Smith, 2002). In contrast, losing weight was a relatively common motive in girls but not in boys (Gillison et al., 2009). For adolescent girls in particular, the pressure to conform to social stereotypes is a key motivator (Allender et al., 2006). Adolescent boys more often reported intrinsic motives, while girls more often reported extrinsic motives (Iannotti et al., 2013; Verkooijen et al., 2009). Gillison et al. (2009) indicate in their study about participation of boys in PA that it forms a large part of their social life and is accepted as something that they would be prepared to do in order to spend time with their friends. Conversely, for girls it was notably separate from their social lives (Gillison et al., 2009).

Understanding why adolescents are physically active or inactive could significantly contribute to the design and delivery of health-promoting interventions. There are several motives and factors that influence whether or not boys and girls participate in PA (Iannotti et al., 2013; Kalman et al., 2015a; Wold, Kannas, 1993). Generally, the older the adolescents are, the less physically active they are (Currie et al., 2012; Kalman et al., 2015b; Kopcakova et al., 2014). However, inconsistent findings are found when comparing cohorts of Slovak and Czech boys and girls over the last decade. A steep decrease of PA after 2002 was followed by a slight increase in 2010 in the Czech republic and 2014 in Slovakia among younger adolescents, characterized by an inconsistent pattern in boys, particularly in older age groups (Currie et al., 2012; Kalman et al., 2015a; Sigmundova et al., 2014b; Currie et al., 2004; Currie et al., 2008; Kopcakova et al., 2015). One of the reasons for gender differences in these trends in the prevalence of PA might be that health-promoting interventions fit better with the motives for PA of girls than of boys. Evidence on these motives and gender differences in them may thus be very useful.

In the present study, we focus on the connection between the motives for PA and the level of PA in adolescence and on potential gender-related differences. The aim of this study is to assess the associations between motives and level of PA among boys and girls.

## Methods

*Sample and Procedure*

We used data from the Health Behavior in School-aged Children (HBSC) cross-sectional study conducted in May–June 2010 in the Czech and Slovak Republics. The HBSC is an international, school-based study conducted in collaboration with the World Health Organization, focusing on the health and health-related behavior of 11-, 13- and 15-year-old school children in their social context. More detailed information about

the HBSC methodology can be found in a paper by Roberts et al. (2009).

*Czech sample:* From a list of schools based on information from the Institute for Information on Education, a contributory organization of the Ministry of Education, Youth and Sport, 91 schools from all 14 regions of the Czech Republic were randomly chosen to create a representative sample. We contacted 91 schools, and 86 schools took part in our survey (school response rate 94.5%). According to the protocol of the HBSC study, classes from the 5th to 9th grades were selected randomly, one from each grade per school. We obtained data from 5284 adolescents from the 5th, 7th and 9th grade of elementary schools in the Czech Republic (response: 87.0%). The HBSC protocol indicates that only 11-, 13- and 15-year-old adolescents should be included, leading to the exclusion of some pupils. Therefore, the final sample consisted of 4404 Czech pupils (mean age = 13.49, 48.0% boys).

*Slovak sample:* From a list of schools based on information from the Slovak Institute of Information and Prognosis for Education, 134 larger and smaller schools located in rural, as well as in urban, areas from all regions of Slovakia were randomly chosen to create a representative sample. We contacted 108 schools, and 106 schools took part in our survey (school response rate 98.1%). According to the protocol of the HBSC study, classes from the 5th to 9th grades were selected randomly, one from each grade per school. We obtained data from 8491 adolescents from the 5th to 9th grade of elementary schools in Slovakia (response: 79.5%). Non-response was primarily due to illness (10.3%) and parental disapproval of the participation of their children (7.4%). Exclusion of those outside the required age-categories led to a final sample consisting of 4614 Slovak pupils (mean age = 13.67, 48.0% boys).

The study was approved by the Ethics Committee of the Faculty of Medicine at the P.J. Safarik University in Kosice, Slovakia. According to Czech legislation the study did not have to be approved by an Ethics Committee, because it consisted of an anonymous questionnaire. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation in the study. Participation in the study was fully voluntary and anonymous with no explicit incentives provided for participation. Questionnaires were administered by trained research assistants in the absence of a teacher during regular class time.

*Measures*

Demographic data (age, gender) were collected using single questions and validated in the Health Behavior in School-aged Children (HBSC) surveys (Currie et al., 2004; Currie et al., 2008).

We asked regarding PA (HBSC): Over the past 7 days, on how many days were you physically active for total of at least 60 minutes per

day? (Currie et al., 2004; Currie et al., 2008). This item was developed by Prochaska et al. (2001) to produce a reliable and valid screening measure of moderate to vigorous physical activity of children and adolescents. To assure that respondents will consider the whole variety of physical activity and will also take into account the intensity item is associated with the following introductory instruction: "Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, school activities, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball or skiing." We used the global WHO recommendation for PA and we dichotomized the respondents into those with sufficient PA (7 days) and those without (0–6 days) (Strong et al., 2005; WHO, 2009; WHO, 2010).

The *motives for PA* were assessed using a question from the HBSC study consisting of 13 items examining why young people undertake leisure-time PA (Wold, Kannas, 1993): Here is a list of reasons that some young people give for taking part in PA in their free time. For each motive please tick how important it is for you, with as categories (1) very important; (2) fairly important; (3) not important; for the following motives (a) to have fun; (b) to be good at sport; (c) to win; (d) to make new friends; (e) to improve my health; (f) to see my friends; (g) to get in good shape; (h) to look good; (i) I enjoy the feeling of using my body; (j) to please my parents; (k) to be cool; (l) to control my weight; and (m) it is exciting. The question was first used as part of an optional PA package in the 1985/86 HBSC survey consisting of 11 items (Wold, Kannas, 1993). Two additional sub-items were added in the 2005/06 HBSC survey, covering weight loss and excitement. For the purpose of this study motives were divided into the four components based on the factor analyses done by Kalman et al. (2015b) with a similar purpose as the SDT of Deci, Ryan (1985) and Ryan, Deci (2000). Items a, f, k, d and m loaded on component 1, which was labeled as *Social motives*; items g, h and l loaded on component 2, labeled as *Health motives*; items e, i and j loaded on component 3, labeled as "Good child" motives, and items b and c loaded on component 4, labeled as Achievement motives. The "Good child" motives are a combination of internal and external motivations according to GCT and SDT (Ryan, Deci, 2000). The higher adolescents scored in each of the motives, the higher the levels of motivation for PA that they reported.

*Statistical Analyses*

As differences between the Slovak and Czech Republics were negligible regarding age, gender, PA and also motives for PA, the analyses were performed in merged samples. Though data were collected in two countries, it is important to indicate that the Czech and Slovak Republics

were together as Czechoslovakia until 1993, when these countries separated. Due to the relatively short separation and the long common history, these two countries still share a very similar cultural and linguistic background, making differences in the findings in this regard rather unlikely (Veselska et al., 2011). We first described the characteristics of the sample by gender, using chi-square and t-tests to assess gender differences. In the next step we used crude and adjusted binary logistic regression, adjusted for age separately for boys and girls, to explore associations between motives for PA (social motives, health motives, "Good child" motives, achievement motives) and sufficient PA (on 7 days per week *vs*. less) among adolescents. In the first model we assessed the crude associations with PA of all groups of motives, and in the second model we assessed the joint associations of groups of motives with PA. The z-scores of latent variables from factor analysis (median = 0, range from −1 to 1) are herein presented. All analyses were performed using IBM SPSS 20 for Windows (IBM Corp. Released 2011).

## Results

The background characteristics of the sample are presented in Table 1. Of the whole study sample 22.2% reported sufficient PA, 17.3% for girls and 28.2% for boys. Boys reported significantly more PA on 7 days/week compared with girls. Girls in comparison to boys scored significantly higher in social and health motives, while boys scored higher in "Good child" and achievement motives.

In the next step we used crude and adjusted binary logistic regression analyses, adjusted for age separately for boys and girls (Table 2). The results, as shown in Table 2, indicate that all motives for PA were associated with PA, after adjustment for differences in age. With mutual adjustment, "Good child" motives and Achievement motives were significantly associated with sufficient PA among both boys and girls. Health motives were associated with sufficient PA only among boys, and Social motives were associated with sufficient PA only among girls.

**Table 1. Descriptive statistics for country, age, sufficient PA and motives for PA for the whole sample and separately for boys and girls.**

| | Total | Gender | | *p*-Value |
|---|---|---|---|---|
| | | Boys | Girls | |
| | (n = 9018) | (n = 4360) | (n = 4654) | |
| **Country: *n* (%)** | | | | ns |
| **Slovakia** | 4614 (51.2) | 2225 (51.0) | 2385 (51.2) | |
| **Czech republic** | 4404 (48.8) | 2135 (49.0) | 2269 (48.8) | |
| **Age: *n* (%)** | | | | <0.01 [a] |
| **11 years old** | 2687 (29.8) | 1315 (30.2) | 1370 (29.4) | |
| **13 years old** | 3204 (35.5) | 1500 (34.4) | 1702 (36.6) | |
| **15 years old** | 3127 (35.5) | 1545 (35.4) | 1582 (34.0) | |
| **Sufficient PA: *n* (%)** | 2006 (22.2) | 1211 (28.2) | 795 (17.3) | <0.001 [a] |
| **Motives for PA: Mean (SD)** | | | | |
| **Social motives** | 4.49 (0.46) | 4.94 (1.01) | 5.05 (0.99) | <0.001 [b] |
| **Health motives** | 4.80 (1.07) | 4.92 (0.98) | 5.08 (1.01) | <0.001 [b] |
| **"Good child" motives** | 4.68 (0.94) | 5.00 (1.02) | 5.00 (0.98) | <0.001 [b] |
| **Achievement motives** | 4.66 (1.09) | 5.30 (1.00) | 4.72 (0.91) | <0.001 [b] |

SD—standard deviation. [a] Chi-square test; [b] t-test.

**Table 2. Associations between motives for PA and sufficient PA (on 7 days per week) adjusted for age: Odds ratios (OR) and 95% confidence intervals (95% CI) from binary logistic regression (crude and adjusted) by gender.**

| | Univariable | | Adjusted for other Motives | |
|---|---|---|---|---|
| | **Boys OR (95% CI)** | **Girls OR (95% CI)** | **Boys OR (95% CI)** | **Girls OR (95% CI)** |
| **Social motives** | 1.10 (1.03–1.18) ** | 1.16 (1.07–1.26) *** | 1.06 (0.99–1.14) ns | 1.17 (1.08–1.28) *** |
| **Health motives** | 1.23 (1.14–1.32) *** | 1.06 (0.98–1.15) ns | 1.17 (1.09–1.26) *** | 1.08 (1.00–1.17) ns |
| **"Good child" motives** | 1.47 (1.36–1.58) *** | 1.24 (1.13–1.35) *** | 1.47 (1.36–1.59) *** | 1.26 (1.16–1.38) *** |
| **Achievement motives** | 1.49 (1.39–1.60) *** | 1.42 (1.30–1.54) *** | 1.50 (1.39–1.61) *** | 1.42 (1.30–1.55) *** |

*** $p < 0.001$; ** $p < 0.01$; ns—not significant.

## Discussion

We explored the associations between motives of PA and the level of PA separately for boys and girls. Our results indicate that associations between motives and the level of PA partially differ by gender. We found that "Good child" motives and achievement motives are associated with the level of PA among boys, and also among girls. Health motives were associated with sufficient PA only among boys, and Social motives were associated with sufficient PA only among girls.

Our study shows that for both boys and girls "Good child" motives and achievement motives were associated with sufficient PA; however, they were rated higher by boys. In other studies (Iannotti et al., 2013; Wold, Kannas, 1993) boys also reported higher rates of achievement motivation than girls, and the association of achievement motives with PA was confirmed in both boys and girls (Iannotti et al., 2013), which is in line with our findings. An explanation for this finding may be that a perception of success, e.g., winning, being good in sport or parental approval, is a very important motivator for adolescent PA, particularly in Europe and North America, as well (Iannotti et al., 2013). If causal, this may direct the design of interventions to improve PA greatly. The achievement and competition element should then be enhanced. However, this runs the risk of mostly attracting those who are good in PA (Allender et al., 2006; Smith, 2003). The balance between this disadvantage and the potential advantages evidently requires further research.

Although girls rated health motives higher than boys, the association of health motives with the engagement in PA was found only among boys. Several other studies provided no consistent evidence for gender

differences in health motives, e.g. Caglar et al. (2009), Wold, Kannas (1993), Litt et al. (2011). In contrast to our findings, the study of Iannotti et al. (2013) found that a higher importance of health motives was associated with a lower level of PA among boys. To get in good shape, to look good and to control weight are aspects of health motives and might be related to body image, which surprisingly starts to be a more important barrier to PA for boys than for girls. Boys are more prone than girls to be physically inactive when they are dissatisfied with their body image (Kopcakova et al., 2014).

Our findings show that social motives are rated higher by girls than by boys and are only associated with PA among girls, which is in line with findings of Wold and Kannas (1993) regarding Finnish, Norwegian and Swedish adolescents, and of Litt et al. (2011) regarding US adolescents. However, Gillison et al. (2009) reported that boys in the UK are more commonly involved in exercising due to social pressure or to attain ego enhancement, which might be perceived as social motives, though the latter in particular may also be interpreted as being mostly very personal. To have fun, to make new friends, to see friends, to be cool or to have an exciting experience are not just rated higher by girls but are also associated with higher engagement in PA in girls, but not in boys, which was also confirmed by Iannotti et al. (2013). These findings are also consistent with the SDT (Ryan, Deci, 2000) showing that one of the motivators for adolescent PA is enjoyment of the activity. The gender difference in the association of social motives with PA may also have consequences for the design of interventions. In particular for girls, social motives are associated with PA, so developing and stressing that component in interventions to promote PA may attract them more than boys.

This study has several important strengths, the most important being the large and representative samples of adolescents and the high response rates. On the other hand, caution in interpreting our results should reflect the limitations of the self-reported measures and cross-sectional design. We used subjective self-reports for measuring the level of PA. Anonymity, confidentiality and also privacy were provided by self-administration of questionnaires in the absence of teachers; this decreased the probability of the over- or under-reporting of health-related behavior (Brener et al., 2003). A review of Brener et al. (2003) reported moderate to high reliability of self-reported PA, supporting the validity of our data. Furthermore, the cross-sectional design of our study makes it impossible to make conclusive inferences about causality based on our findings. Our findings therefore need to be confirmed in studies with a longitudinal design.

Significant associations between motives for PA and the level of PA in our findings underline the importance of such motives in adolescents (the higher the score, the more important motive). In order to increase the

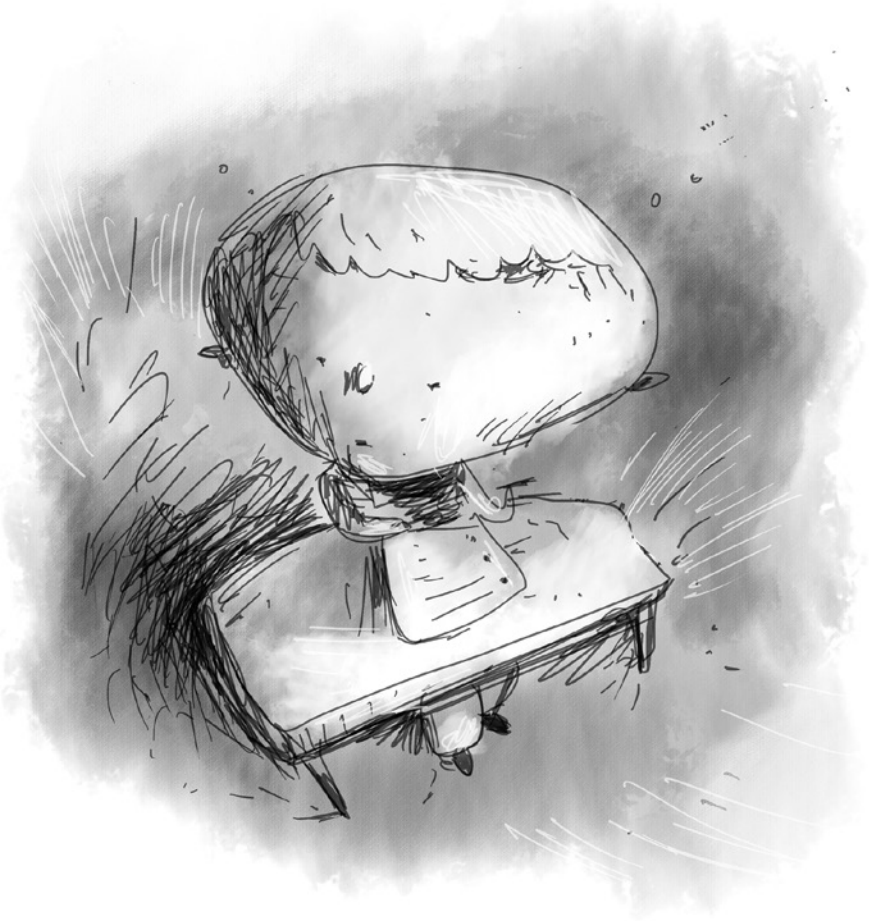
efficiency and successful implementation of the developed programs for promotion of PA, they need integrate specific motives for PA. Our results indicate that associations between motives and the level of PA partially differ by gender. We found that "Good child" motives and achievement motives are associated with the level of PA among boys, and also among girls. Therefore, one should be aware of different motivations for engagement in PA and prepare interventions in line with this. Focusing on the "Good child" motives and achievement motives in planned programs for the promotion of PA will fit the needs of both girls and boys and might increase their engagement in physical activity. At the same time working with social motives might be effective only among girls, while working with health motives might be effective only among boys, as associations of these motives with physical activity differ with gender according to our results.

We found cross-sectional associations between the motives for PA and the level of PA, which should preferably be confirmed in longitudinal research in future to establish that the motives for PA cause the level of PA and further be explored in qualitative research regarding the underlying mechanisms. Efforts to increase PA in childhood and adolescence need to determine which motives are effective for the particular population being targeted. However, more research on this topic needs to be undertaken before the association between motives for PA and PA among adolescents is more clearly understood, especially through understanding of other possible variables influencing motives for PA.

## Conclusions

When policy makers and practitioners are planning public health strategies and interventions they should take into account the motives that are more likely associated with a high level of PA. The associations between motives for PA and level of PA partially differ by gender. These gender differences regarding the relations between the four motives (social, health, "Good child" and achievement motives) for PA and engagement in PA among adolescents should be considered in interventions focusing on enhancement of PA.

# 5 | Test-retest reliability of a questionnaire on motives for physical activity among adolescents



Chapter 5

# Test-retest reliability of a questionnaire on motives for physical activity among adolescents

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*Submitted*

## Abstract

*Background:* The aim of this study was to investigate the test-retest reliability of the motives for PA items from the HBSC questionnaire among Czech and Slovak adolescents, and differences by gender, age group and country. *Methods:* We obtained data from 580 students aged 11 and 15 years old (51.2% boys) who participated in a test and retest study with a four-weeks interval in 2013 via the Health Behaviour in School-aged Children pilot study in the Czech Republic and Slovakia. We estimated the test-retest reliability of all 13 dichotomised motives by using Intraclass Correlation Coefficients (ICC) and Cohen's Kappa statistics, for continuous and dichotomised motives, respectively. *Results:* Test-retest reliability showed moderate agreement for nine motives (ICC from 0.41 to 0.60) and fair agreement for four motives (ICC from 0.33 to 0.40). Kappa statistics were similarly moderate to large (0.33 to 0.61), except for three motives with small or trivial correlations. The motives "To improve my health" and "To enjoy the feeling of using my body" had consistently low kappas and correlations. *Conclusion:* Overall, the results of this study suggest that most questions on motives for PA on the HBSC questionnaire have acceptable test-retest characteristics for use among adolescents.

**Keywords:** physical activity; motives for physical activity; test-retest reliability; adolescents; gender

## Introduction

Low levels of physical activity (PA) during adolescence contribute to obesity and poor health outcomes in adolescence, and these associations endure into adulthood (Iannotti et al., 2009; Currie et al., 2012; Telama, 2009; Hallal et al., 2006; Bauman et al., 2012). As suggested by several studies, one of the potential pathways leading to an increase in levels of PA is through their associations with particular motives for PA (e.g. Nigg, 2003; Kopcakova et al., 2015; Iannotti et al., 2013; Wold et al., 2015). A better understanding of motives for being physically active or inactive could significantly contribute to evidence-based development of national strategies for public health and active living (Kopcakova et al., 2015; Kalman et al., 2015b; Jodkowska et al., 2015) and may increase the effects of interventions.

Motives for PA tend to differ by gender and age. Boys used to report higher rates of achievement motivation than girls, but lower rates of social and health motives than girls (Kopcakova et al., 2015); social and health motives used to be more prevalent in older adolescents than in younger, while achievement motives used to be more prevalent in older adolescent boys and in younger adolescent girls (Kalman et al., 2015b).

Some instruments exist for measuring motives to undertake PA and are widely used, but we know little about their stability over time, which is necessary for the valid assessment of behavioural patterns. To the best of our knowledge only Ojala et al. (2005) has investigated the test-retest reliability and validity of motives for PA items, having done so among Scandinavian students. In this study an instrument similar that of the HBSC study was used, and the test-retest stability was found to be acceptable for most of the motives for PA. However, it might not be possible to generalise findings from Northern or Western Europe to Eastern Europe without caution and verification (Iannotti et al., 2013). Moreover, gender and age differences exist in the prevalence of particular motives for undertaking PA (Kopcakova et al., 2015; Iannottii et al., 2013; Wold et al., 2015; Kalman et al., 2015b).

Therefore, the aim of this study is to investigate the test-retest reliability of the motives for undertaking PA among Slovak and Czech adolescents and to determine whether this reliability differs by gender and age group (11- and 15-year-olds). Based on our knowledge, no previous study has been devoted to the test-retest reliability of adolescent motives for PA since questions on this subject were first used in the 1985/86 Health Behaviour in School-aged Children (HBSC) survey.

## Methods

*Sample and procedure*

This test-retest study is based on the international HBSC cross-sectional study and is consistent with its methodology. HBSC is carried out in collaboration with the World Health Organization every four years and focuses on the health and health-related behaviour of 11-, 13- and 15-year-old school children in their social context. More detailed information about the HBSC methodology can be found in Roberts et al. (2009). Randomly chosen primary schools in the Olomouc and Pardubice region, Czech Republic (7 schools), and the Kosice region, Slovakia (5 schools), were approached in November and December 2013. Questionnaires were administered in the 5th and 9th grades by trained research assistants in the absence of a teacher during regular class time. In the first part of the data collection (Test) we obtained data from 419 adolescents in the Czech Republic (response rate: 83.20%) and 259 adolescents in Slovakia (response rate: 74.14%). Non-response was primarily due to illness and parental disapproval of the participation of their children.

The second part of the data collection (Retest) was conducted 4 weeks after the first part. We obtained data from 353 adolescents in Czech Republic (66 dropped out, 15.7%) and 227 adolescents in Slovakia (32 dropped out, 12.3%) who also participated in the first part of the data collection (Test). The final sample consisted of 353 Czech (51.9% boys) and 227 Slovak (52.9% boys) primary school pupils, grades five and nine.

The study was approved by the Ethics Committee of the Faculty of Physical Culture, Palacky University in Olomouc (decision from May 15th 2013) and by the Ethics Committee of the Medical Faculty at P J Safarik University in Kosice (decision from June 18th 2012). The schools selected in the Czech Republic have a general permission granted at the beginning of the school year by all parents. Parents in Slovakia were informed about the study via the school administration and could opt out if they disagreed with it. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation in either country.

*Measures*

Demographic data (age, gender) were collected using the single questions used and validated in the Health Behaviour in School-aged Children (HBSC) surveys (Currie et al., 2008; Currie et al., 2012).

The *motives for PA* were assessed using 13 items from the HBSC study examining why young people undertake leisure time PA (Wold & Kannas, 1993). The question reads as follows: "Here is a list of reasons that some young people give for taking part in PA in their free time. For each motive please tick how important it is for you, with as answers (1) very important; (2) fairly important; (3) not important". Respondents reply for

13 motives for PA (Figure 1, Table 2). Further, we dichotomised all of the items by combining (1) very important and (2) fairly important vs. (3) not important (see Table 3). The question was first used as part of an optional PA package in the 1985/86 HBSC survey (Wold & Kannas, 1993). From the 2005/06 HBSC onward, a survey on two additional sub-items was also used, specifically the items: "to control my weight" and "it is exciting".

*Statistical analyses*

In the first step we computed frequencies of the background characteristics. Next, we assessed the proportion of respondents who answered a question identically or shifted their response by one or two categories in the test and retest. Third, we used Intraclass Correlation Coefficients (ICC) to estimate the test-retest reliability of all selected items for the whole sample and stratified by gender, age group and country. In the final step, we computed Cohen's Kappa coefficients with dichotomised variables for the whole sample and stratified by gender, age group and country.

According to Landis and Koch's subjective guidelines (Landis, Koch, 1977), the strength of test-retest agreement for an ICC greater than 0.81 is considered to be almost perfect agreement; 0.61 to 0.80 is considered to be substantial agreement; 0.41 to 0.60 is considered to be moderate agreement; 0.21 to 0.40 is considered to be fair agreement; and an ICC below 0.20 is considered to be poor. Regarding Cohen's Kappa statistics correlation coefficients greater than 0.5 are considered to be large, 0.3–0.5 moderate, 0.1–0.3 small and less than 0.1 are considered to be trivial (Cohen, 1988). All data were analysed using IBM SPSS 20 for Windows (IBM Corp. Released 2011).

## Results

The background characteristics (prevalence rates) of the sample in the test and retest can be seen in Table 1.

The proportion of respondents who answered a question identically varied from 62% to 73% in the Czech Republic and from 56% to 71% in Slovakia (Figure 1).

Table 2 shows the ICCs for the HBSC items regarding motives for PA by gender, age group and country. Across subgroups and motives, the ICC varied from 0.29 to 0.65, which indicates fair to moderate agreement. Test-retest reliability showed moderate agreement for nine motives (ICC from 0.41 to 0.60) and fair agreement for four motives (ICCs from 0.33 to 0.40 for "to have fun", "to improve my health", "to see my friends" and "to enjoy the feeling of using my body") in the whole sample. Motives for PA tended to have greater agreement in girls than in boys. Likewise, most motives for PA tended to have greater agreement in the 15-year-old adolescents than in the 11-year-old adolescents. Agreement tended to be

better for adolescents in Slovakia than for those in the Czech Republic for most of the items.

We dichotomised all motives according to WHO recommendations and we created binary variables for further analyses. Table 3 shows Cohen's Kappa for the HBSC items regarding motives for PA by gender, age group and country. We observed strong or moderate correlations between test and retest for 10 out of 13 motives in the whole sample. Moreover, we also observed strong or moderate correlations between test and retest for most of the motives per stratum of gender, age group and country. Weak correlations were observed regarding two motives ("to make new friends" and "to enjoy the feeling of using my body") and a trivial correlation in the motive "to improve my health" in the whole sample and also per gender, age group and country. Using binary format resulted in similar findings like using continuous format of motive variable. The only exception was the motive "To improve my health" which showed different results and trivial agreement after dichotomisation. The test-retest reliability of motives for PA tended to be better in boys than in girls. Six of the motives for PA had a somewhat better reliability in 15-year-old adolescents than in 11-year-old adolescents (a, b, c, g, i, l). Likewise reliability tended to be better in Slovakia than in the Czech Republic for most motives for PA.

**Figure 1 Percentage of test-retest response shifts in motives for physical activity items counted separately for Slovakia and Czech Republic.**

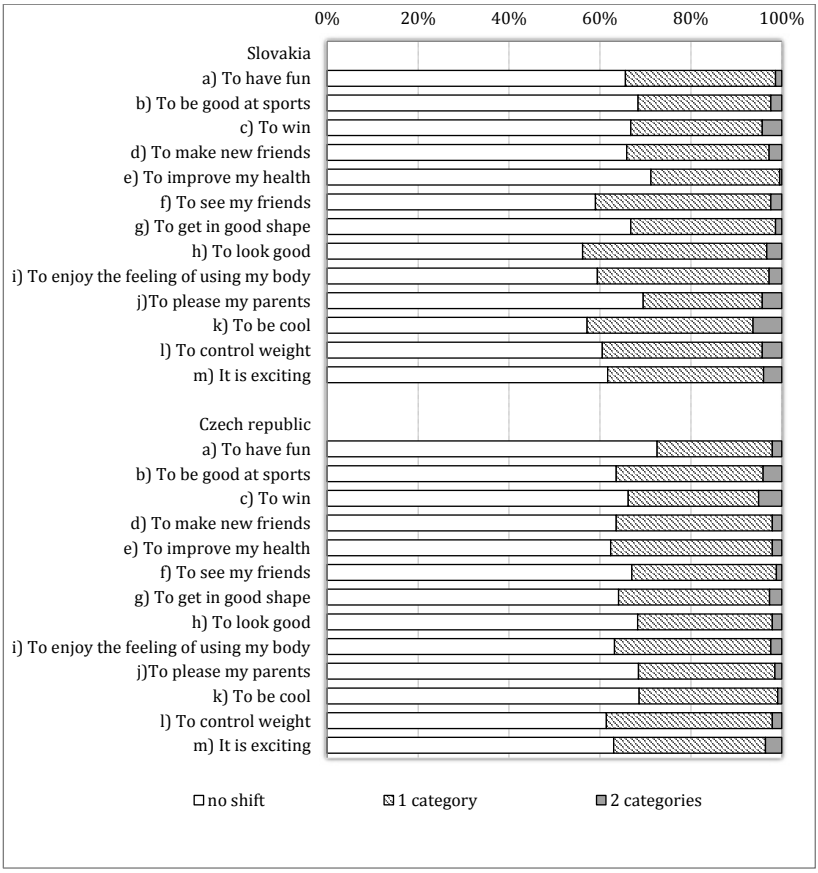

**Table 1 Demografic characteristics of the sample (Slovakia and Czech Republic, 2013).**

| | Test | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | 11-year-olds | | 15-year-olds | |
| | n | % | n | % | n | % | n | % |
| Slovakia | 134 | 38.2 | 125 | 38.3 | 132 | 37.5 | 127 | 39.0 |
| Czech Republic | 217 | 61.8 | 201 | 61.7 | 220 | 62.5 | 199 | 61.0 |
| TOTAL | 351 | 100.0 | 326 | 100.0 | 352 | 100.0 | 326 | 100.0 |

| | reTest | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | 11-year-olds | | 15-year-olds | |
| | n | % | n | % | n | % | n | % |
| Slovakia | 120 | 40.4 | 107 | 37.8 | 114 | 36.9 | 113 | 41.7 |
| Czech Republic | 177 | 59.6 | 176 | 62.2 | 195 | 63.1 | 158 | 58.3 |
| TOTAL | 297 | 100.0 | 283 | 100.0 | 309 | 100.0 | 271 | 100.0 |

**Table 2 ICC for HBSC items regarding motives for physical activity by gender, age group and country (Slovakia and Czech Republic, 2013).**

| | | Gender | | | | | | Age | | | | Country | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All (n = 580) | | Boys (n =297 ) | | Girls (n =283) | | 11 years (n =309 ) | | 15 years (n =271 ) | | Slovakia (n = 227) | | Czech (n =353 ) | |
| | ICC | 95% CI | ICC | 95% CI | ICC | 95% CI | ICC | 95% CI | ICC | 95% CI | ICC | 95% CI | ICC | 95% CI |
| **Motives for PA** | | | | | | | | | | | | | | |
| a) To have fun | 0.38°° | 0.31-0.45 | 0.36°° | 0.26-0.46 | **0.41°°** | 0.30-0.50 | 0.32°° | 0.22-0.42 | **0.46°°** | 0.35-0.55 | 0.36°° | 0.24-0.48 | 0.40°° | 0.31-0.49 |
| b) To be good at sports | **0.56°°** | 0.50-0.61 | **0.55°°** | 0.46-0.62 | **0.54°°** | 0.45-0.62 | **0.46°°** | 0.36-0.54 | 0.65°°° | 0.58-0.72 | 0.64°°° | 0.55-0.71 | **0.50°°** | 0.42-0.58 |
| c) To win | **0.59°°** | 0.54-0.65 | **0.65°°°** | 0.57-0.71 | **0.48°°** | 0.38-0.57 | **0.58°°** | 0.49-0.65 | 0.61°°° | 0.53-0.68 | 0.64°°° | 0.55-0.71 | **0.56°°** | 0.48-0.63 |
| d) To make new friends | **0.44°°** | 0.37-0.50 | **0.42°°** | 0.32-0.52 | **0.45°°** | 0.35-0.54 | 0.38°° | 0.27-0.47 | **0.46°°** | 0.36-0.55 | **0.49°°** | 0.38-0.58 | 0.40°° | 0.30-0.48 |
| e) To improve my health | 0.33°° | 0.25-0.40 | 0.29°° | 0.18-0.39 | 0.36°° | 0.25-0.46 | 0.28°° | 0.17-0.38 | 0.38°° | 0.28-0.48 | 0.40°° | 0.28-0.50 | 0.28°° | 0.18-0.38 |
| f) To see my friends | 0.40°° | 0.33-0.47 | 0.38°° | 0.27-0.48 | **0.43°°** | 0.33-0.52 | **0.44°°** | 0.34-0.53 | 0.36°° | 0.25-0.46 | 0.30°° | 0.17-0.42 | **0.47°°** | 0.38-0.55 |
| g) To get in good shape | **0.50°°** | 0.44-0.56 | **0.45°°** | 0.35-0.54 | **0.56°°** | 0.47-0.63 | **0.45°°** | 0.36-0.54 | **0.56°°** | 0.47-0.64 | **0.54°°** | 0.43-0.63 | **0.48°°** | 0.39-0.56 |
| h) To look good | **0.58°°** | 0.52-0.64 | **0.60°°** | 0.52-0.67 | **0.57°°** | 0.48-0.64 | **0.60°°** | 0.52-0.67 | **0.54°°** | 0.45-0.62 | **0.51°°** | 0.40-0.61 | 0.63°°° | 0.56-0.69 |
| i) To enjoy the feeling of using my body | 0.39°° | 0.32-0.46 | 0.35°° | 0.25-0.45 | **0.41°°** | 0.31-0.51 | 0.35°° | 0.24-0.45 | **0.42°°** | 0.31-0.51 | 0.30°° | 0.17-0.42 | **0.44°°** | 0.35-0.52 |
| j) To please my parents | **0.56°°** | 0.50-0.62 | **0.50°°** | 0.40-0.58 | 0.62°°° | 0.54-0.69 | **0.45°°** | 0.36-0.54 | **0.51°°** | 0.41-0.59 | **0.57°°** | 0.47-0.66 | **0.55°°** | 0.48-0.62 |
| k) To be cool | **0.60°°** | 0.54-0.65 | **0.59°°** | 0.51-0.66 | 0.61°°° | 0.52-0.68 | **0.58°°** | 0.50-0.66 | 0.61°°° | 0.53-0.68 | **0.54°°** | 0.44-0.63 | 0.36°° | 0.27-0.45 |
| l) To control weight | **0.46°°** | 0.39-0.52 | **0.43°°** | 0.32-0.52 | **0.49°°** | 0.39-0.57 | **0.41°°** | 0.30-0.50 | **0.50°°** | 0.40-0.59 | **0.44°°** | 0.32-0.54 | **0.47°°** | 0.38-0.55 |
| m) It is exciting | **0.54°°** | 0.48-0.60 | **0.58°°** | 0.49-0.65 | **0.49°°** | 0.39-0.57 | **0.54°°** | 0.45-0.62 | **0.54°°** | 0.45-0.62 | **0.55°°** | 0.45-0.64 | **0.52°°** | 0.44-0.60 |

°°°ICC value > 0.81- perfect agreement; °°°0.61-0.80 - substantial agreement; °° 0.41-0.60 - moderate agreement; °°0.21-0.40 - fair agreement;
°ICC value<0.20 poor agreement (Landis, Koch, 1977).

**Table 3 Cohen's Kappa coefficients with dichotomised variables for HBSC items regarding motives for physical activity by gender, age group and country (Slovakia and Czech Republic, 2013).**

| Items | | Gender | | Age | | Country | |
|---|---|---|---|---|---|---|---|
| | All (n = 580) | Boys (n =297 ) | Girls (n =283) | 11 years (n =309 ) | 15 years (n =271 ) | Slovakia(n = 227) | Czech (n =353 ) |
| | Cohen's Kappa | Cohen's Kappa | Cohen's Kappa | Cohen's Kappa | Cohen's Kappa | Cohen's Kappa | Cohen's Kappa |
| **Motives for PA** | | | | | | | |
| a) To have fun | 0.36** | 0.29** | 0.41** | 0.21** | 0.59** | 0.45** | 0.27** |
| b) To be good at sports | 0.50** | 0.50** | 0.48** | 0.41** | 0.57** | 0.66** | 0.39** |
| c) To win | 0.56** | 0.67** | 0.44** | 0.54** | 0.58** | 0.61** | 0.53** |
| d) To make new friends | 0.28** | 0.30** | 0.27** | 0.34** | 0.24** | 0.37** | 0.18** |
| e) To improve my health | -0.03 | -0.02 | -0.03 | -0.03 | -0.02 | -0.02 | -0.03 |
| f) To see my friends | 0.36** | 0.41** | 0.32** | 0.40** | 0.29** | 0.28** | 0.41** |
| g) To get in good shape | 0.33** | 0.29** | 0.37** | 0.17** | 0.57** | 0.32** | 0.34** |
| h) To look good | 0.54** | 0.59** | 0.48** | 0.55** | 0.46** | 0.46** | 0.60** |
| i) To enjoy the feeling of using my body | 0.25** | 0.20** | 0.29** | 0.23** | 0.28** | 0.14* | 0.30** |
| j) To please my parents | 0.48** | 0.41** | 0.54** | 0.56** | 0.43** | 0.53** | 0.43** |
| k) To be cool | 0.61** | 0.60** | 0.61** | 0.65** | 0.57** | 0.47** | 0.39** |
| l) To control weight | 0.42** | 0.46** | 0.37** | 0.38** | 0.45** | 0.33** | 0.48** |
| m) It is exciting | 0.51** | 0.61** | 0.42** | 0.53** | 0.47** | 0.58** | 0.44** |

* p < 0.05; **p<0.01

## Discussion

The aim of the study was to examine the test-retest reliability of the motives for PA items of the HBSC questionnaire in Czech and Slovak adolescents by age and by gender. The motives for PA items showed moderate agreement for most motives in the whole sample and also stratified by gender, age group and country. After dichotomisation we observed a moderate correlation between the test and retest in almost all examined items, exceptions being small correlations for the motives "to make new friends" and "to enjoy the feeling of using my body" and a trivial correlation for the motive "to improve my health".

The test-retest reliability was moderate for nine motives and fair for four motives in the whole sample, and was somewhat better in girls than in boys, and in 15-year-old adolescents than in 11-year-old adolescents. According to our knowledge, no previous study assessed the test-retest reliability of adolescents' motives for PA as used in HBSC study. We therefore can only compare our findings with those on adjacent concepts. Ojala et al. (2005) reported in a study on motives for exercise that test-retest reliability was acceptable for adolescents, using a similar instrument as in the HBSC study. Wold et al. (2015) assessed changes in motives for PA among adolescents from 1986 to 2006. They found that adolescents in 2006 tended to report higher importance of motives for PA than adolescent of the same age 20 years earlier in Finland, Norway and Wales. Among similar measured constructs such as e.g. motives for food choice (Markovina et al., 2015), and motives of smoking (Fiala et al., 2010; Boudrez & De Bacquer, 2012), test-retest reliability was found to be acceptable.

With further similar patterns as for the ICC we observed strong or moderate correlations between test and retest for ten out of thirteen dichotomised motives, both in the whole sample, and per stratum of gender, age group and country.

*Strengths and limitations*

This study has a number of important strengths, including a large sample size, comprising adolescents from two countries, collected according to a standardized protocol. Furthermore, the period between test and retest administration (4 weeks) was sufficiently long to avoid the retention of previously chosen answers and sufficiently short to avoid changes in lifestyle patterns.

Some limitations should be taken into account concerning the present study. First, in this study reliability was only analysed using ICC and Cohen's Kappa. Assessing the reliability of motives for PA items is arguable and depends on different strictness of criteria suggested by different authors. Another potential limitation is that this study focused

on the reliability of the selected items but did not investigate their validity; this would be an issue for future research.

## Conclusion

Motives for PA showed mostly moderate agreement and a similarly mostly strong or moderate correlation after dichotomisation in both genders in 11- and 15-year-old adolescents. We conclude that the HBSC questionnaire on motives for PA is an acceptable instrument to measure motives for PA among adolescents. Continuous-level variables could be used as best responses on this questionnaire; these responses are more stable over time than dichotomised responses. The study offers unique and interesting insights into how adolescents perceive motives for PA in the Czech and Slovak Republics.

# 6 Are school factors and urbanization supportive for being physically active and engaging in less screen-based behaviour?

Chapter 6

# Are school factors and urbanization supportive for being physically active and engaging in less screen-based activities?

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## Abstract

*Objectives:* The aim of this study was to assess the association between physical activity and screen-based activities in adolescents and selected school factors and urbanization and whether these association were modified by degree of urbanization. *Methods:* We obtained data regarding 5th to 9th grade students from 130 schools in 2014 via the Health Behaviour in School-aged Children cross-sectional study in Slovakia (n=9,743, mean age=13.5, 50.3% boys). Using multilevel logistic regression we explored the associations of accessibility of sports facilities at school, active breaks at school and degree of urbanization with physical activity and screen-based activities in a model adjusted for age and gender. *Results:* We found significant associations between physical activity and the accessibility of an area for skating/tennis court (odds ratio (OR)=1.20, 95% confidence interval (CI) 1.01-1.42), and between physical activity and active breaks (OR=0.83, 95%-CI 0.69-0.99). The rates of screen-based activities were higher in small towns (OR=1.63, 95%CI 1.29–2.06), towns (OR=1.30, 95%-CI 1.08–1.57), and cities (OR=1.40, 95%-CI 1.04–1.87) than in villages. *Conclusion:* School environment and degree of urbanization are associated with adolescents' physical activity and screen-based activities. This holds for access to an area for skating/tennis court and active breaks regarding physical activity and for living in villages regarding less use of screens.

**Keywords:** physical activity, screen-based behaviour, accessibility of sports facilities at school, active breaks, degree of urbanization, adolescence

## Introduction

Physical activity and screen-based activities are of major importance for youth development. Previous studies have demonstrated that some physical environmental characteristics in the school setting can influence students' activity level (Haug et al. 2008; Haug et al. 2010; Czerwinski et al. 2015; Sallis et al. 2001; Davison et al. 2006). After the school day has ended, adolescents are more likely to do screen-based activities and less likely to engage in e.g. physical activity (Mahoney, 2011). In addition, some studies in the review of Pate et al. (2011) investigated the associations between measures of sedentary behaviour and the degree of urbanization among sampled children and adolescents, but this yielded heterogeneous findings. On the one hand, studies of Davey (2008) conducted in China and of Kourlaba et al. (2009) conducted in Greece found that living in urban areas was related to higher levels of screen-based activities. On the other hand, studies of Loucaides et al. (2004) conducted in Cyprus and of Gordon-Larsen et al. (2000) in the US did not find any association between the studied variables. Physical activity is essential for long- and short-term physical and mental health and may improve academic and cognitive performance (Bauman et al. 2012; Biddle et al. 2011). Screen-based activities have been shown to be an important risk factor for physical, psychological and socio-emotional health among youth (Chastin et al. 2016).

The majority of the adolescents do not meet current recommendations for physical activity of at least 60 minutes moderate-to-vigorous physical activity per day (WHO 2010) and for screen-based activities of no more than 2 hours per day (American Academy of Pediatrics, 2001; Tremblay et al. 2011) (Currie et al. 2012; Kalman et al. 2015a; Bucksch et al. 2014; Brindova et al. 2015), but connections between these two behaviours are unclear. The alarmingly low prevalence of sufficient physical activity and high prevalence of screen-based activities underline the need for a better understanding of the determinants of daily physical activity and screen-based activities among children and adolescents. These are prerequisites for developing from healthy adolescence into adulthood (Inchley et al. 2016). It might be inferred that more screen-based activities lead to less physical activity, but studies show no or only a weak relationship between these two activities (Inchley et al. 2016; Nelson et al. 2006). Young people do not always fall into one group or the other; adolescents can have high levels of physical activity and screen-based activities and vice versa (Currie et al. 2012; Pearson et al. 2014). An explanation for this may be that an increase in screen-based activities could, generally, be considered as being at least partially a result of the development of new technologies surrounding adolescents in everyday life, including school or family. For example, it is very common that adolescents replace one screen-based

activity (e.g. watching TV) by another (e.g. work with PC) and there are still many options for doing screen-based activities (Biddle et al. 2014).

Adolescents spend most of their awake time sitting during the school day. Sitting and being quiet during school time is often seen as a desired behaviour and adolescents may also some part of the day in the school use different screen-devices (as cell phone, iPad, etc.). As adolescents spend a considerable portion of their day at school, school institutional factors may be important determinants of students' health and health behaviour (Spence and Lee 2003). This may, for instance, be due to the physical environment a school offers and the social environment, with various social connections between students (King et al. 2002). The Health Behaviour in School-aged Children (HBSC) study has shown that the physical environmental characteristics of schools (i.e. facilities for physical activity) relate to students' daily physical activity at school (Haug et al. 2008; Haug et al. 2010), but evidence on the connection between school facilities and screen-based activities is lacking. Some of the school environmental effects may in fact be due to the socio-economic position of individuals (Rydin et al. 2012).

Both, physical activity and screen-based activities of adolescents could be explained for the purpose of this study (and also in line with the HBSC methodology) in terms of a socio-ecological approach. According to ecological models, higher levels of physical activity and lower levels of screen-based activities are expected when environments and policies support physical activity, when social norms and social support for engagement in physical activity are strong, and when individuals are motivated and educated to be active (Sallis et al., 2006).

Therefore, the aim of the present study was first to assess whether the availability of sports facilities at school (gymnasium; space for ball activities; playground; area for skating; tennis court) and of active breaks and degree of urbanization is associated with physical activity and screen-based activities among Slovak adolescents. Second, we assessed whether the former were modified by degree of urbanization.

## Methods

*Sample and procedure*

We used data from the HBSC study conducted in 2014 in Slovakia. To obtain a representative sample, we used a two-step sampling. In the first step, 151 larger and smaller elementary schools located in rural as well as in urban areas from all regions of Slovakia were asked to participate. These were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education. Schools in the first-mentioned sample were then listed in a random order. In the second step, we approached schools in the sequence of the list

until we had obtained a representative sample of 11-, 13- and 15- year old Slovak pupils of sufficient size. This was realised when 130 schools agreed to participate in our survey (response rate: 86.1%). We obtained data from 10,179 adolescents from the 5th to the 9th grades (response rate: 78.8%), from which we removed 436 adolescents due to lacking information on age to reach a more homogeneous sample. We also obtained 130 school level questionnaires from the principal or vice principal of the schools (response rate: 100.0%). Our final sample consisted of 9,743 adolescents (mean age = 13.5, 50.3% boys).

The study was approved by the Ethics Committee of the Medical Faculty at the P. J. Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation. Questionnaires were administered by trained research assistants in the absence of a teacher during regular class time.

*Measures*

*Individual-level data based on questionnaires*

Demographic data (*age, gender*) were collected using single questions that are used and validated in the HBSC surveys (Currie et al. 2012; Inchley et al. 2016).

*Physical activity* was measured by an item asking adolescents about the number of days over the past week that they were physically active for a total of at least 60 minutes per day. The question was preceded by an explanatory text that defined moderate-to-vigorous activity as ''any activity that increases your heart rate and makes you get out of breath some of the time'', offering examples of such activities (running, inline skating, cycling, dancing, swimming, ice skating etc.) (Currie et al. 2012; Inchley et al. 2016). Responses could vary from 0 to 7 days per week and were classified as sufficient - physical activity of 7 days vs. insufficient - less (from 0 to 6 days), based on the WHO recommendations (WHO, 2010).

*Screen-based activities* concerned watching TV, playing computer games and working with computer, measured by three separate items. Watching TV was measured by the question: "How many hours a day, in your free time, do you usually spend watching television, videos (including YouTube or similar services), DVDs and other entertainment on a screen?" Computer gaming was measured by asking: "How many hours a day, in your free time, do you usually spend playing games on a computer, games console, tablet (like iPad), smartphone or other electronic devices (not including moving or fitness games)?" Computer work was assessed by asking: "How many hours a day, in your free time, do you usually spend using electronic devices such as computers, tablets

(like iPad) or smartphones for other purposes, for example, homework, e-mailing, tweeting, facebook, chatting, surfing the internet" (Currie et al. 2012; Inchley et al. 2016; Torsheim et al. 2010). In our study we combined these three separate items into one composite variable called screen-based activities. Following the recommendations of the American Academy of Pediatrics (2001) and Tremblay et al. (2011), time spent on screen-based activities was dichotomised as excessive (2 and more hours/day) and non-excessive (less).

*School-level data based on questionnaires*

*Degree of urbanization* was assessed by a single question to the principal or vice-principal of the schools: "Which of the following best describes the community in which your school is located?" with four categories: (1) A village, hamlet or rural area (fewer than 3,000 people), (2) A small town (3,000 to 15,000 people), (3) A town (15,000 to 100,000 people), (4) A city (more people).

*Active breaks (active recess)* was measured by asking the principal or vice-principal of the schools: "Does your school organise physical activities during the school day outside physical education classes during breaks?" with four categories as follows: (1) Yes, every day, (2) Yes, 3-4 days a week, (3) Yes, 1-2 days a week, (4) No. Responses were dichotomized as active breaks 3 days per week and more, and less.

*Accessibility of sports facilities at school* was measured by asking the principal or vice-principal of the schools if students had access to such facilities during unstructured school time (breaks, free hours): (1) Gymnasium, sport hall, (2) Football and/or soccer field or court space with permanent improvements for other ball activities, (3) Playground, (4) Areas for boarding/skating or tennis court, with "yes" and "no" response categories.

*Statistical analyses*

First, we described the sample using descriptive statistics. Next, we assessed the relationships between physical activity and screen-based activities as dependent variables and the accessibility of sports facilities at school, active breaks and degree of urbanization as independent variables using multilevel logistic regression models adjusted for age and gender. Furthermore, we assessed adjustments of models for family affluence (the instrument used within the HBSC study as indicator of SES of adolescents), and then also for number of sports facilities at school. Finally, we assessed whether the association of accessibility of sports facilities at school and active breaks with physical activity and screen-based activities was modified by the degree of urbanization, again using multilevel logistic regression models adjusted for age and gender. All analyses were performed using Stata version 11.0.

## Results

The background characteristics of the sample are presented in Table 1. Our study sample consisted of 9,743 from 11 to 16 years old adolescents (mean age = 13.5, mean number of students per school = 74.9). In addition, we used Intraclass Correlation Coefficients (ICC) to estimate physical activity (ICC=0.036) and screen-based activities (ICC=0.030) items for the whole sample.

Table 2 presents the odds ratios (OR) and 95% confidence intervals (CI) from the multilevel logistic regression analyses. Sufficient physical activity was not associated with the accessibility of sports facilities and degree of urbanization among adolescents. We only found a significant positive association between physical activity and the accessibility of an area for skating or a tennis court and a negative association between physical activity and active breaks. Screen-based activities were not associated with any of the studied determinants, except that excessive screen-based activities among adolescents occurred more frequently in small towns, towns and cities than in villages. Next, we assessed the relationships between physical activity and screen-based activities and the accessibility of sports facilities at school, active breaks and degree of urbanization as independent variables using multilevel logistic regression models adjusted for family affluence (the instrument used within the HBSC study as indicator of SES of adolescents), and then also adjusted for the number of sports facilities at school. These adjustments did not change the associations in an important way (data not presented).

Finally, we assessed whether the association between accessibility of sports facilities at school and active breaks with physical activity and screen-based activities was modified by the degree of urbanization. None of these interactions was statistically significant (not presented).

**Table 1 Descriptive characteristics of the sample, Health Behaviour in School-aged Children study collected in Slovakia in 2014.**

| | | N (%) |
|---|---|---|
| Gender | Boys | 4892 (50.3) |
| | Girls | 4830 (49.7) |
| Age | 11-12 years old | 2761 (28.3) |
| | 13-14 years old | 4202 (43.1) |
| | 15-16 years old | 2780 (28.5) |
| Physical activity | 0-6 days | 6997 (75.0) |
| Screen-based activities | Every day (recommended) | 2338 (25.0) |
| | Less than 2 hours | 1548 (18.4) |
| | 2 hours and more/day | 6881 (81.6) |
| Gymnasium | Yes | 3046 (34.0) |
| | No | 5912 (66.0) |
| Space for ball activities | Yes | 6388 (71.3) |
| | No | 2570 (28.7) |
| Playground | Yes | 4670 (52.1) |
| | No | 4288 (47.9) |
| Area for skating/tennis court | Yes | 2721 (30.6) |
| | No | 6158 (69.4) |
| Active breaks | 3-5 days per week | 2779 (24.4) |
| | Less than 3 days per week | 7079 (75.6) |
| Degree of urbanization | Village | 2427 (24.9) |
| | Small town | 1992 (20.4) |
| | Town | 4335 (44.5) |
| | City | 989 (10.2) |

Notes: Number of missing cases per variable: Gender - 21; Age - 0; Physical activity - 408; Screen-based activities - 1314; Gymnasium - 785; Space for ball activities - 785; Playground - 785; Area for skating/tennis court - 864; Active breaks - 385; Degree of urbanization - 0.

**Table 2 Associations between physical activity, screen-based activities and accessibility of sports facilities at school, active breaks and degree of urbanization, adjusted for age and gender: Odds ratios (OR) and 95% confidence intervals (95%-CI) from multilevel logistic regression, Health Behaviour in School-aged Children study collected in Slovakia in 2014.**

| | | Physical activity OR (95%-CI) | Screen-based activities OR (95%-CI) |
|---|---|---|---|
| Gymnasium | | 1.01 (0.86-1.20) $^{ns}$ | 1.05 (0.88-1.26) $^{ns}$ |
| Space for ball activities | | 1.04 (0.87-1.25) $^{ns}$ | 0.91 (0.75-1.10) $^{ns}$ |
| Playground | | 1.12 (0.95-1.31) $^{ns}$ | 0.96 (0.81-1.14) $^{ns}$ |
| Area for skating/tennis court | | 1.20 (1.01-1.42) * | 1.08 (0.90-1.30) $^{ns}$ |
| Active breaks | | 0.83 (0.69-0.99) * | 1.06 (0.87-1.29) $^{ns}$ |
| Degree of urbanization | | | |
| | Village | 1 (reference) | 1 (reference) |
| | Small town | 0.99 (0.79-1.25) $^{ns}$ | 1.62 (1.29-2.05) *** |
| | Town | 1.16 (0.96-1.41) $^{ns}$ | 1.30 (1.07-1.57) ** |
| | City | 1.01 (0.76-1.35) $^{ns}$ | 1.39 (1.04-1.87) * |

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ns- not significant; reference = reference group.

## Discussion

We found a significant association between schools having an area for skating or a tennis court and having active breaks and physical activity among adolescents. Furthermore, we found that adolescents in small and bigger towns are more likely to be engaged in screen-based activities than in villages. The association between accessibility of sports facilities at school and active breaks with physical activity and screen-based activities was not modified by the degree of urbanization.

We found that physical activity was negatively associated with active breaks at school among Slovak adolescents. Previous studies (Haug et al. 2008; Verstraete et al. 2006) have shown that promoting adolescents' physical activity through active breaks can contribute to achieving the daily recommended physical activity levels. Our finding contradicts those of previous studies, as we found physical activity to be lower in case of active recess. It is probably not only exceptional case, because similar findings were found among adolescents from the Czech Republic (Sigmundova, oral comunication); in country where physical activity have a better tradition. A possible explanation of our findings could be that young people with access to environmental resources such as physical activity during breaks at school may not necessarily use them (Haug et al. 2008). During breaks, students are free to do what they want. Another

explanation could be that the information on active breaks as given by the school management might differ from the students' own 'experience of activity', thus explaining the negative association with physical activity. In addition, we provided focus groups within the additional qualitative study "Voice of children" based on the results from quantitative HBSC study. Findings showed that despite the principals or vice principals of school declared the access to environmental resources such as physical activity during breaks, children reported that they don´t have. Finally, active breaks may be a response to low physical activity levels and then are not fully able to counteract these low physical activity levels. Based on our cross-sectional data we cannot discriminate between these three explanations.

Our findings also indicate that physical activity was not associated with the accessibility of most sports facilities at school, the exceptions being the availability of an area for skating or a tennis court. Previous studies have demonstrated that some physical environmental characteristics in the school setting can influence students' activity level (Haug et al. 2008; Haug et l. 2010; Czerwinski et al.2015; Sallis et al. 2001; Davison and Lawson 2006). These results are partially in line with our findings linking higher physical activity to the availability of some activity-related equipment and the accessibility of certain permanent activity structures beside the school yard (Davison and Lawson 2006; Durant et al. 2009; Millstein et al. 2011). Another explanation of our results might be that those children who are attending schools with higher standards, such as those with accessibility of an area for skating or a tennis court, are more well off and are also prone to be more physically active. Studying the role of socioeconomic position as a potential common cause of both physical activity and school environment requires further research in this field.

Our study shows that children in either small or bigger towns are more prone to screen-based activities than in villages, but not in relation to school environmental characteristics. Research on the association between adolescents' screen-based activities and degree of urbanization is scarce. One exception is a study of young Swiss children which showed that the associations of screen-based activities were not explained by the built environment (Bringolf-Isler et al. 2015). In addition, some studies from different socio-cultural context in the review of Pate et al. (2011) investigated the associations between measures of sedentary behaviour and the degree of urbanization among sampled children and adolescents, but this findings were mixed. In our study screen-based activities were not associated with the accessibility of sports facilities or active breaks at school, respectively, which is not in line with previous research (Davison and Lawson 2006; Durant et al. 2009; Millstein et al. 2011).

*Strengths and limitations*

The main strengths of this study are its large sample size, the representative national dataset and our multilevel approach. However, some limitations have to be discussed as well. A first limitation is the cross-sectional design of our study, which hinders conclusive inferences about causality. Our findings therefore need to be confirmed in longitudinal or experimental studies. Another limitation is that we obtained information on accessibility of sports facilities and active breaks at school only from one informant in the school management. This may be quite different from students' experiences. Last, we used subjective self-reports for measuring the level of physical activity and screen-based activities, which might be considered as limitation. However, anonymity, confidentiality as well as privacy were provided by self-administration of questionnaires in the absence of teachers; this decreased the probability of the over- or under-reporting of health-related behaviour (Brener et al. 2003).

*Implications*

We found associations of access to an area for skating/tennis court and active breaks with physical activity and also an association of degree of urbanization with screen-based activities. The findings regarding skating/tennis court may guide actions to improve physical activity, but need confirmation in longitudinal or experimental research.

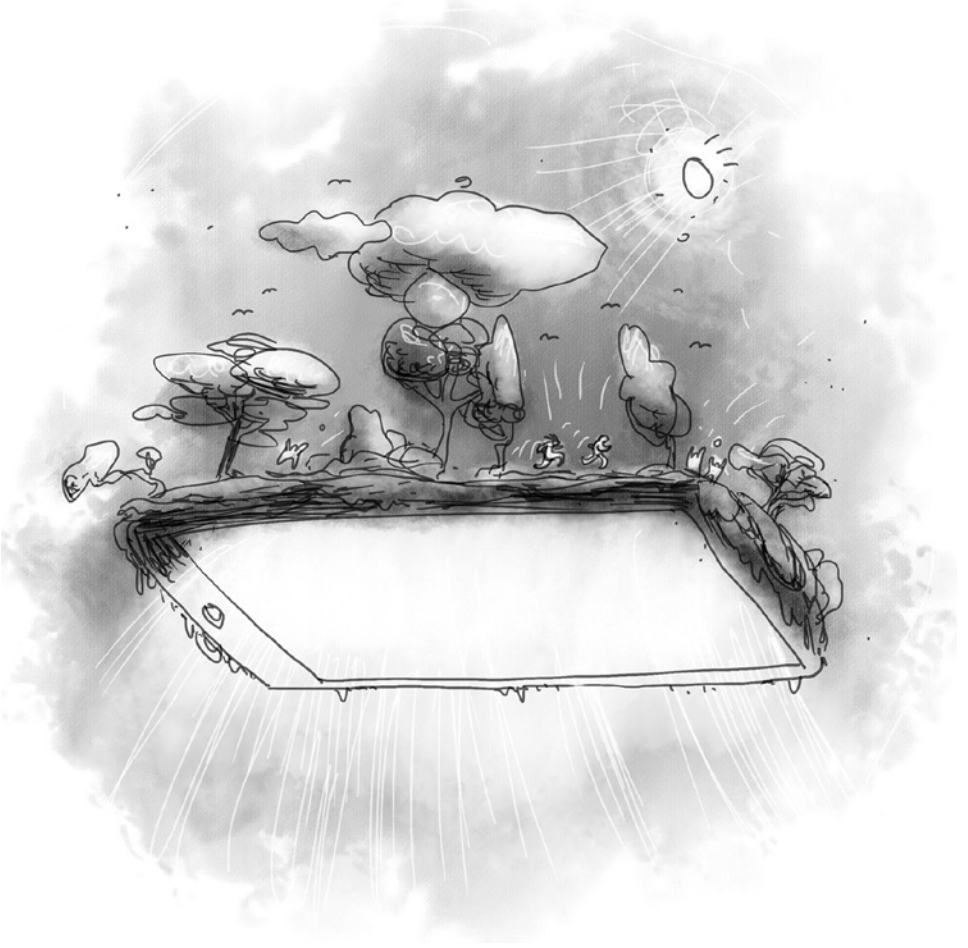
Moreover, adolescents from smaller and larger cities were at more risk for using of more screen-based activities in comparison with adolescents from villages. Therefore, it is important take a closer look at the reasons for use of screen-based activities of these adolescents, and to support their active lifestyle. There is also a special need to study this topic in more detail and at the same time to explore whether the school environment (e.g. by organizing competitions, attractive gameplay elements, the possibility of renting equipment etc.) and degree of urbanization really motivates adolescents for being active. Moreover, it is important to take a closer look on the technical equipment, types of activities, attractiveness, and active recruitment for sport facilities at schools because accessibility of sport facilities and activity during breaks are not enough for being more active and less sedentary. Adolescents probably may need some facilitators which will support their active lifestyle. In addition, information on accessibility of sport facilities and active breaks at school were given by the school management and might differ from the perceived availability from students, therefore in future research we need to triangulate this data.

Last, but not least, studying the role of social connections as a potential common cause of both physical activity and screen-based activities requires further research in this field.

## Conclusion

School environment and active breaks are associated with adolescents' physical activity and degree of urbanization is associated with their screen-based activities. This holds positively for access to an area for skating/tennis court and negatively for active breaks regarding physical activity. Adolescents from small towns, towns and cities were at higher risk for use of many screen-based activities than adolescents from villages. The environmental factors offer additional cues to gain in adolescent health.

# 7 | Is a perceived activity-friendly environment associated with more physical activity and fewer screen-based activities in adolescents?



Chapter 7

# Is a perceived activity-friendly environment associated with more physical activity and fewer screen-based activities in adolescents?

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## Abstract

*Background:* The aim of this study is to explore if perception of an activity-friendly environment is associated with more physical activity and fewer screen-based activities among adolescents. *Methods:* We collected self-reported data in 2014 via the Health Behaviour in School-aged Children cross-sectional study on four European countries (n = 13,800, mean age =14.4, 49.4% boys). We explored the association of perceived environment (e.g. "There are other children nearby home to go out and play with") with physical activity and screen-based activities using a binary logistic regression model adjusted for age, gender, family affluence and country. *Results:* An environment perceived as activity-friendly was associated with higher odds that adolescents meet recommendations for physical activity (Odds ratio (OR) for 1 standard deviation (SD) change=1.11, 95%-confidence interval (CI) 1.05-1.18) and lower odds for excessive screen-based activities (OR for 1SD better=0.93, 95%-CI 0.88-0.98). *Conclusion:* Investment into an activity-friendly environment may support the promotion of active life styles in adolescence.

**Keywords:** physical activity, screen-based activities, perceived activity-friendly environment, adolescence

## Introduction

A higher level of physical activity and a lower level of screen-based activities are of major importance for the development of youth and for physical, psychological and socio-emotional health (Bauman et al., 2012; Sigmundova et al., 2014b; Sallis et al., 2016; Carson et al., 2016). They offer numerous health benefits to adolescents (Bauman et al., 2012; Inchley et al., 2016). It is recommended that adolescents participate in physical activity for at least 60 min daily (WHO, 2010) and in screen-based activities for no more than 2 h daily (Tremblay et al., 2011). Recent studies (Inchley et al., 2016; Kalman et al., 2015a; Bucksch et al., 2014; Currie et al., 2012) indicated that only a minority of adolescents meet the current guidelines for physical activity and screen-based activities.

There is a growing body of literature that recognizes the importance of various determinants regarding physical activity and screen-based activities, such as, e.g., the level of urbanization (Kopcakova et al., under review), and the parents' own level of physical activity (Sigmundova et al., 2014a). An environment perceived as activity-friendly may affect both physical activity and screen-based activities, but the mechanism is not clear. Recent evidence from an international cross-sectional study of adults suggests that a physical activity-friendly environment may be important for the promotion of physical activity (Sallis et al., 2016), and this might also affect screen-based activities. However, studies among adolescents within a European context are scarce (Ding et al., 2011; Ommundsen et al., 2008).

Taking into account the importance of the how adolescents perceive their environment and the scarcity of evidence, the aim of this study was to explore if perception of an activity-friendly environment is associated with adolescents' behavior in terms of physical activity and screen-based activities using data from a European context.

## Materials and Methods

*Sample and Procedure*

The Health Behavior in School-aged Children (HBSC) study is a World Health Organization (WHO) collaborative cross-national study with a standardized methodological approach. All procedures are conducted in accordance with the study protocol prepared by the HBSC International Coordinating Center. Data are collected every four years from a nationally representative sample of 11-, 13- and 15-year-old adolescents from the 45 member countries. The primary sampling units are schools and classes. In some countries specific items are not asked for 11-year-old adolescents. More detailed information about the HBSC methodology can be found in Roberts et al. (2009).

We include four countries (Czech Republic, Germany, Poland and Slovakia) that collected data on physical activity and screen-based activities (watching TV, computer use for gaming and non-gaming purposes) and on the optional package about physical activity-related correlates of the social and physical environment (labelled as the 'perceived environment'). To obtain a comparable sample in all four countries we present data on 13- to 16-year-old school children from the latest survey wave in 2014 and exclude 11-year-old adolescents, as only some countries included these questions for this age category. Each of the country-specific samples was based on a nationally representative randomized cluster (i.e., school level) sampling procedure. In total 13,800 (mean age = 14.4, 49.4% boys) students were recruited. Surveys were administered by the class teachers/trained research assistants during regular class time; participation was voluntary, and confidentiality of the participants was ensured. Response rates varied per country (89.2% in the Czech Republic, 72.5% in Germany, 86.1% in Poland and 78.8% in Slovakia). Non-response was mainly due to illness (Czech Republic, Poland and Slovakia), parental disapproval of the participation of their children (Germany, Poland and Slovakia) and children's disapproval of the participation in the study (Czech Republic).

The study was conducted in accordance with the Declaration of Helsinki, and protocols were approved in Czech Republic by the Ethics Committee of the Faculty of Physical Culture, Palacky University Olomouc (No. 17/2013), in Germany by the Ethics Committee of the University Hospital Hamburg, in Poland by the Bioethics Committee at the Institute of Mother and Child no 20/2013 within the project funded by the National Science Center, No. 2013/09/B/HS6/03438, and in Slovakia on 18 June 2012 by the Ethics Committee of the Medical Faculty at the P. J. Safarik University in Kosice (No.: 9/2012) under the project APVV 0032-11.

*Measures*

We collected data on age and gender by using single questions which were validated in previous HBSC surveys (Inchley et al., 2016; Currie et al., 2012).

Family affluence was measured using the Family Affluence Scale III (FAS III), which consists of six questions: 'Does your family own a car, van or truck' (No/Yes, one/Yes, two or more)? 'Do you have your own bedroom for yourself' (No/Yes)? 'How many computers does your family own' (None/One/Two/More than two)? 'How many bathrooms (room with a bath/shower or both) are in your home' (None/One/Two/More than two)? 'Does your family have a dishwasher at home' (No/Yes)? 'How many times did you and your family travel out of your country for a holiday/vacation last year?' (Not at all/Once/Twice/More than twice)? We converted the FAS summary scores to a final score, which has a normal distribution and a range from 0 to 1. We then created tertile

categories of low (0 to 0.333), medium (0.334 to 0.666) and high (0.667 to 1) socio-economic position (Elgar et al., 2015).

Moderate-to-vigorous physical activity was measured by an item asking adolescents about the number of days over the past week that they were physically active for a total of at least 60 min per day. The question was preceded by an explanatory text that defined moderate-to-vigorous activity as 'any activity that increases your heart rate and makes you get out of breath some of the time' and offered examples of such activities (running, inline skating, cycling, dancing, swimming, ice skating etc.) (Inchley et al., 2016; Currie et al., 2012). Responses concerned zero to seven days per week and were classified as sufficient—physical activity of seven days vs. less—insufficient, based on the WHO recommendation (2010).

Screen-based activities (during the week), represented by watching TV, playing computer games and working with computer, were computed using three separate items. Watching TV was measured by the question: "How many hours a day, in your free time, do you usually spend watching television, videos (including YouTube or similar services), DVDs, and other entertainment on a screen?" Computer gaming was measured by asking: "How many hours a day, in your free time, do you usually spend playing games on a computer, games console, tablet (like iPad), smartphone or other electronic devices (not including moving or fitness games)?" Computer work was assessed by asking: "How many hours a day, in your free time, do you usually spend using electronic devices such as computers, tablets (like an iPad) or smartphones for other purposes, for example, homework, emailing, tweeting, Facebook, chatting, surfing the Internet" (Inchley et al., 2016; Currie et al., 2012; Torsheim et al., 2010). In our study we combined these three separate items into one composite variable called screen-based activities. Following the latest evidence-based recommendation of the Canadian sedentary behavior guidelines for children and youth (Tremblay et al., 2011), time spent on screen-based activities was dichotomised as excessive at least in one screen-based activity (two and more hours/day) and non-excessive (less than 2 h).

Perceived environment was measured using a five-item scale derived from the European Youth Heart Study (Ommundsen et al., 2008). Respondents were asked to respond to the following statements: "It is safe to walk or play alone in my neighborhood during the day."; "There are other children nearby home to go out and play with."; "There is somewhere at home I can go out and play."; "There are playgrounds or parks close to my home where I can play." and "At school there are playgrounds or fields where I can run around.". Each item had three response categories, i.e., definitely yes, undecided, definitely no.

*Statistical Analyses*

First, we used descriptive analyses to show the frequencies of gender, family affluence, country, moderate-to-vigorous physical activity and screen-based activities in the whole sample. Next, we analyzed the factor structure of the perceived environment. Principal Component Analysis (PCA) with Varimax rotation was conducted. Following the identification of the final factor model, one latent standardised and normalised variable was created (labelled as the 'perceived environment') and used in the remaining analyses. The higher adolescents scored in each item of the activity-friendly environment, the higher the levels of activity-friendly environment that they reported. Third, we performed logistic regressions on the association of the perceived environment with moderate-to-vigorous physical activity and screen-based activities, adjusted for age, gender, family affluence and country. Analyses were conducted with SPSS v21 (IBM, Armonk, NY, USA).

## Results

The background characteristics of the sample are presented in Table 1.

**Table 1. Descriptive characteristics for the whole sample.**

| | | N (%) |
|---|---|---|
| Gender | boys | 6,822 (49.4) |
| | girls | 6,978 (50.6) |
| Family Affluence | low | 3,844 (29.5) |
| | medium | 5,517 (42.4) |
| | high | 3,659 (28.1) |
| Country | Slovakia | 3,142 (22.8) |
| | Czech Republic | 3,481 (25.2) |
| | Germany | 4,174 (30.2) |
| | Poland | 3,003 (21.8) |
| Physical activity | sufficient (7 days) | 2,182 (16.9) |
| | not sufficient | 10,739 (83.1) |
| Screen-based activities | excessive (2+ hours /day) | 10,967 (83.2) |
| | non-excessive | 2,212 (16.8) |

Notes: Number of missing cases per variable: Gender - 0; family affluence – 780; country – 0; physical activity – 879; screen-based activities – 621.

Next, the PCA yielded one latent standardized and normalized variable (labeled as the 'perceived environment') (Kaiser-Meyer-Olkin Measure of Sampling Adequacy value was 0.68; Bartlett's test of sphericity was statistically significant ($p < 0.001$)). Table 2 presents the perceived environment factors represented by one component (labeled as Perceived environment).

**Table 2. Outcomes of a Principal Component Analysis with Varimax rotation of the perceived environment factors in the sample.**

| | Component 1<br>Perceived environment |
|---|---|
| There are other children nearby home to go out and play with | 0.68 |
| There is somewhere at home I can go out and play | 0.69 |
| It is safe to walk or play alone in my neighbourhood during the day | 0.45 |
| There are playgrounds or parks close to my home where I can play | 0.63 |
| At school there are playgrounds or fields where I can run around | 0.43 |

Table 3 presents the odds ratios (OR) and 95% confidence intervals (CI) for the perceived environment, with physical activity and screen-based activity from the binary logistic regression analyses adjusted for age, gender, family affluence and country. A sufficient moderate-to-vigorous physical activity was associated with the adolescent perception that the environment promotes physical activity (OR for one standard deviation (SD) change = 1.11, 95% CI 1.05–1.18). We also found a significant association between excessive screen-based activities and perceived environment (OR for 1 SD better = 0.93, 95% CI 0.88–0.98). The perception of an activity-friendly environment was associated with lower odds of excessive screen-based activities among adolescents.

**Table 3. Associations of the perceived environment with physical activity and screen-based activity, adjusted for age, gender, family affluence scale and country: Odds ratios (OR) and 95% confidence intervals (95%-CI) from binary logistic regression.**

| | | Physical activity | Screen-based activities |
|---|---|---|---|
| | | OR (95%CI) | OR (95%CI) |
| Age (per year) | | 0.86 (0.82-0.91) *** | 1.30 (1.24-1.36) *** |
| Gender | girls | 1 (ref.) *** | 1 (ref.) ** |
| | boys | 1.62 (1.46-1.80) | 1.17 (1.06-1.30) |
| FAS | low | 1 (ref.) *** | 1 (ref.) ns |
| | medium | 1.12 (0.98-1.29) | 1.12 (0.99-1.27) |
| | high | 1.60 (1.39-1.85) | 1.07 (0.93-1.22) |
| Country | Slovakia | 1 (ref.)*** | 1 (ref.) *** |
| | Czech Republic | 1.48 (1.26-1.72) | 0.80 (0.69-0.93) |
| | Germany | 0.86 (0.73-1.01) | 0.74 (0.64-0.85) |
| | Poland | 1.49 (1.24-1.79) | 0.69 (0.58-0.81) |
| Perceived environment (1 SD better) | | 1.11 (1.05-1.18) *** | 0.93 (0.88-0.98) ** |

Notes: *** $p < 0.001$; ** $p < 0.01$; ns- not significant; ref. = reference group;
SD = standard deviation.

## Discussion

We found that a higher perception of an activity-friendly environment was significantly associated with higher odds that adolescents meet the recommendations for physical activity among the four European countries studied. Furthermore, we found that a perception of the environment as more activity-friendly was associated with lower odds of excessive screen-based activities among adolescents. Moreover, our study also showed that younger adolescents, boys and adolescents from highly affluent families tend to meet physical activity recommendations and that older adolescents and boys tend to do more excessive screen-based activities in four European countries.

Our study confirmed the findings of previous studies (Ding et al., 2011; Haug et al., 2008; Haug et al., 2010; Millstein et al., 2011) showing that promoting adolescents' physical activity through a perceived activity-friendly environment is associated with achieving the daily recommended physical activity levels. In contrast, a study by Bringolf-Isler et al. (2015) in Swiss children found that environmental factors were not associated with physical activity. As similar associations were found in most other studies, it might be expected that a more general pattern is present. However, the discrepancy with the study by Bringolf-Isler et al. (2015) also suggests that other possible factors might play a role that causes these differences and should be explored further.

We found that perception of the environment as activity-friendly was significantly associated with excessive screen-based activities among adolescents. This is in line with previous research, which suggests that the built environment may be key in promoting an active lifestyle among adolescents (Davison, Lawson, 2006). Our findings are in line with previous studies among Australian children and youth (Veitch et al., 2011; Christian et al., 2015). Veitch et al. (2011) showed that parental satisfaction with the quality of their local parks was associated with less computer time, and that greater public open spaces were associated with less TV viewing among children. However, research on the association between adolescents' perception of an activity-friendly environment and screen-based activities within the European context is scarce and comparison with the previously mentioned Australian studies might be problematic based on different cultural backgrounds.

Moreover, it might be inferred that more screen-time activities lead to less physical activity, but screen-time activities and physical activity are recognized as independent constructs, and various studies have highlighted the relative independence of these two behaviours (Christian et al., 2015). In that sense we are using two separate outcome variables that are intertwined. It is important to indicate that moderate-to-vigorous physical activity and screen-based activities among adolescents are not

strongly related to each other, so using them as separate entities/outcomes might be justified.

The main strengths of this study are its large sample size and the representative international dataset. However, some limitations have to be discussed as well. A first limitation is the cross-sectional design of our study, which hinders conclusive inferences about causality. Our findings therefore need to be confirmed in longitudinal or experimental studies. Another limitation is that we used subjective self-reports for measuring the level of moderate-to-vigorous physical activity and screen-based activities, which may lead to their misclassification and biased estimates. Next, using a binary outcome of moderate-to-vigorous physical activity might be pointed out as a limitation, but the distribution of the variable does not allow many other alternatives. However, more classifications (i.e., use of cut-offs) exist for being physically active vs. not being physically active. For the purpose of the present study we adhered to a frequently used classification, i.e., the WHO recommendation (seven days = active vs. less = inactive) (WHO, 2010).

We found that a higher perception of an activity-friendly environment was associated with higher odds that adolescents will meet recommendations for physical activity and with lower odds of excessive screen-based activities. These findings may guide actions to increase physical activity and reduce screen-based activities of adolescents, but they need confirmation in longitudinal or experimental research.

Moreover, it seems that adolescents' moderate-to-vigorous physical activity and screen-based activities are linked; adolescents can be active and sedentary on the same day. Therefore, it is important to take a closer look at investments into an activity-friendly environment to promote moderate-to-vigorous physical activity and to reduce screen-based activities in adolescence and to support their active lifestyle. However, based on existing age and gender differences in the prevalence of physical activity and screen-based activities, it seems that such activities among adolescents should take into account different approaches for the investment into an activity-friendly environment.

## Conclusions

The perceived environment is associated with adolescents' physical activity and their screen-based behavior. Investment into an activity-friendly environment might, among other factors, play a role in the promotion of an active lifestyle in adolescence.

# 8 General discussion

Chapter 8

# General discussion

The aim of this thesis was to examine the relationships between adolescents´ physical activity and screen-based activities and the associations of these behaviours with potential determinants (e.g. body image, motives to physical activity, school environment, degree of urbanization, perceived activity-friendly environment). Additionally, this thesis also explored the role of gender, age and socioeconomic differences in these associations.

This final chapter summarises (8.1) and discusses the main findings of the study (8.2). Next, the methodological considerations of the study (8.3) and the implications of the findings for practice, policy and future research (8.4) are addressed.

## 8.1 Main findings

The main findings are summarized per research question.
Research question 1:
*Do associations of body image and gender with physical activity exist? (Chapter 3)*
We found that adolescents with a negative body image less often engage in regular sufficient physical activity than others, and that boys are more likely to be sufficiently physically active. Poor body image among girls did not affect their physical activity, whereas poor body image among boys was associated with a lower likelihood of reaching the recommended level of moderate to vigorous physical activity.

Research question 2:
*Does an association exist between motives for physical activity and the level of physical activity among adolescent boys and girls? (Chapter 4)*
Our results indicate that associations between motives for physical activity (social motives, health motives, "good child" motives, achievement motives) and the level of physical activity partially differ by gender. We found that "good child" motives and achievement motives are associated with the level of PA among boys, and also among girls. Health motives were associated with sufficient PA only among boys, and social motives were associated with sufficient physical activity only among girls.

Research question 3:
*Are the motives for undertaking physical activity items from the HBSC questionnaire reliable among adolescents and does this reliability differ by gender, age group and country? (Chapter 5)*

The motives for undertaking physical activity items from the HBSC questionnaire showed a moderate agreement for most motives in the whole sample and also stratified by gender, age group and country. After dichotomisation we observed moderate test and retest correlation coefficients for almost all examined items such as "to have fun"; "to be good at sports"; "to win"; "to see my friends"; "to get in good shape"; "to look good"; "to please my parents"; "to be cool"; "to control weight" and "it is exciting". The only exceptions were three motives with weak or trivial correlation.

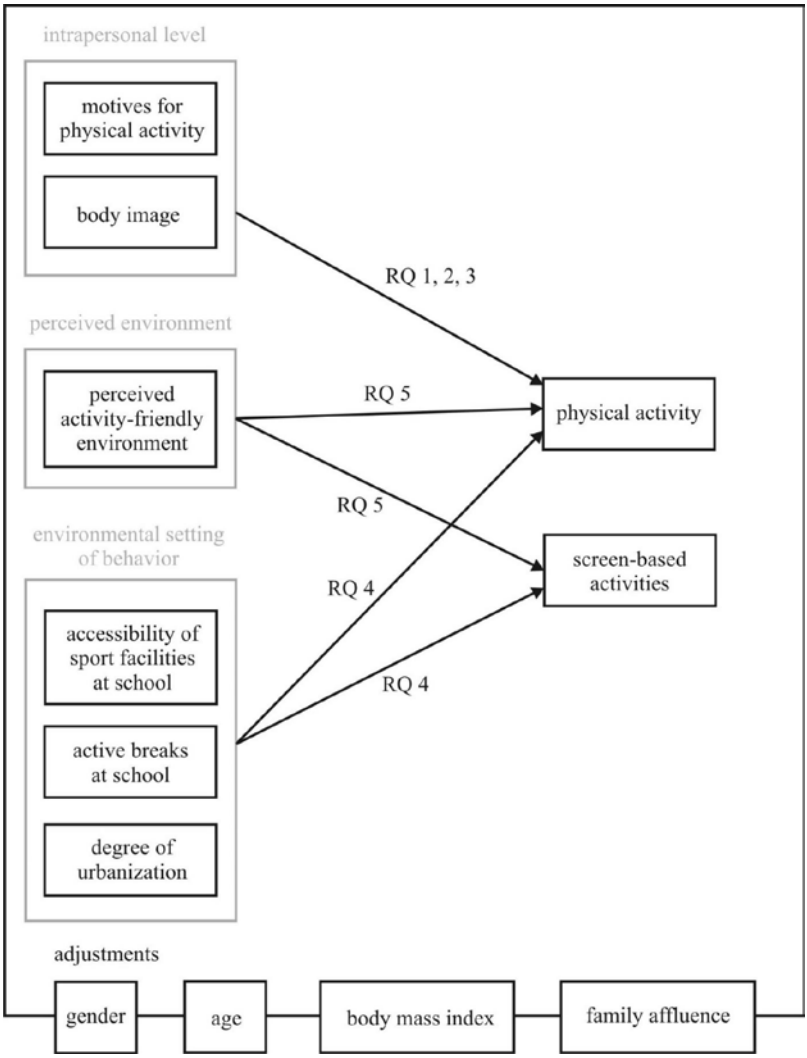
Research question 4:
*Are the school environment and degree of urbanization supportive for being more physically active and engaging in less screen-based activities among adolescents? (Chapter 6)*
We found a significant association between schools having an area for skating or a tennis court and having active breaks and PA among adolescents. Furthermore, we found that adolescents in small and bigger towns were more likely to be engaged in SB activities than in villages. The association between the accessibility of sports facilities at school and active breaks with PA and SB activities was not modified by the degree of urbanization.

Research question 5:
*Is a perceived activity-friendly environment associated with adolescent´s behaviour in terms of physical activity and screen-based activities? (Chapter 7)*
We found that perception of the environment as more activity-friendly was significantly associated with a higher probability that adolescents meet the recommendations for physical activity among the four European countries studied: the Czech Republic, Slovakia, Poland and Germany. Furthermore, we found that perception of the environment as more activity-friendly was associated with a lower probability of adolescent's excessive screen-based activities in the four European countries studied. Moreover, younger adolescents, boys and adolescents from highly affluent families tended to meet physical activity recommendations more frequently, while older adolescents and boys tended to have more excessive screen-based activities in the four European countries.

## 8.2 Discussion of the main findings

The main findings of this thesis will be discussed within the framework of the general aims, as outlined in Chapter 1, and repeated in Figure 8.1. We will focus on the relationships between adolescents' physical activity and screen-based activities and the associations of these behaviours with potential determinants. Finally, we will also discuss the role of country (Figure 8.1).

**Figure 8.1 Model of the relationships examined in the thesis.**



### 8.2.1 Physical activity, screen-based activities and their potential determinants

Physical activity and screen-based activities have an important impact on youth development (Inchley et al., 2016). During the last years a discussion has been taking place about the connection between these two behaviours, and it might be inferred that more screen-time activities lead to less physical activity. However, screen-time activities and physical activity are recognised as independent constructs, and various studies have highlighted the relative independence of these two behaviours (Mansoubi et al., 2014; Pearson et al., 2014).

A relatively low level of physical activity and a high level of screen-based activities were highly prevalent among Slovak adolescents. In comparison to other European countries adolescents from Slovakia in all age groups and in both genders could be at the same time physically active and still sedentary. The same pattern can be found in other European countries, such as Bulgaria, Albania, Ukraine or Croatia. Both physical activity and screen-based activities of adolescents could be explained in terms of a socio-ecological approach, and the results of this thesis will be discussed in terms of this approach (Sallis et al., 2006). Ecological models refer to adolescent´s interaction with their physical and socio-cultural surroundings. Therefore, for the purpose of this thesis we will discuss its results as the relationships between adolescents' physical activity and screen-based activities and the associations of these behaviours with intrapersonal level, perceived environment and the environmental setting of the behaviour.

*Intrapersonal level*

We found that body image is associated with physical activity among adolescents and also that some gender differences exist. Among adolescent girls poor body image did not affect their physical activity, whereas poor body image among boys was associated with a lower probability of reaching the recommended level of moderate to vigorous physical activity (WHO, 2010). This leads to boys, not girls, being prone to be physically inactive when they are dissatisfied with their body image. This gender difference regarding the association of body image seems to originate from different sociocultural expectations. Boys and girls also differ, e.g. in self-perception and motivation. Generally, boys are more engaged in organized and free-time activities (Badura et al., 2015) with the aim of being part of peer relationships, which is not connected directly with the way they perceive themselves. Therefore, it is also important to take a closer look at the motivation for physical activity and possible barriers to it among adolescents.

We found that motives for physical activity were associated with the level of physical activity, and that this association was partially gender dependent. "Good child" motives and achievement motives were associated with the level of physical activity among boys, and also among girls. Health motives were associated with sufficient physical activity only among boys, and social motives were associated with sufficient physical activity only among girls. It was already known that motivation is a personal characteristic that may be one of the key factors for understanding why some people are physically active in their leisure time (Aaltonen et al., 2014). Moreover, the amount of physical activity and the motives for physical activity differ highly by gender (Aaltonen et al., 2014; Iannotti et al., 2013; Caglar et al., 2009; Verkooijen et al., 2009; Kalman et al., 2015b) and by age (Verkooijen et al., 2009; Kalman et al., 2015b). Our findings are mostly in line with previous studies (e.g. Iannotti et al., 2013; Wold&Kannas, 1993; Litt et al., 2011) and also with the self-determination theory (Ryan&Deci, 2000). Motives for physical activity thus vary by gender, and this aligns with differences in physical activity.

In addition, we found that the HBSC questionnaire on motives for physical activity is an acceptable instrument to measure motives for physical activity among adolescents. The continuous-level responses on this questionnaire could better be used than the dichotomised ones, as these continuous-level responses were more stable over time. Motives thus not only align with actual levels of physical activity but can also be measured pretty reliably.

*Perceived environment*

We found that a perception of the environment as more activity-friendly was significantly associated with higher odds that adolescents meet the recommendations for physical activity in the four European countries studied. Our study confirms the findings of previous studies (Ding et al., 2011; Haug et al., 2008; Haug et al., 2010; Millstein et al., 2011) showing that promoting adolescents' physical activity through a perceived activity-friendly environment is associated with better achievement of the daily recommended physical activity levels. In contrast, Bringolf-Isler et al. (2015) found that perceived environment was not associated with the physical activity of adolescents. An explanation for this may be that adolescents' perceptions of environments are not similar to more objective aspects of environments. Both perception and actual environment are likely to be important influences (Sallis et al., 2006). Our findings, based on data from young European adolescents, may then be interpreted as that in Central Europe adolescent perception may play at least some role in their actual behaviour.

Moreover, this study showed that perception of the environment as more activity-friendly was significantly associated with less excessive

screen-based activities among adolescents. This is in line with previous research, which suggests that the built environment may be a key in promoting a non-sedentary, more active lifestyle among adolescents (Davison, Lawson, 2006). Our findings are in line with previous studies among Australian children and youth (Veitch et al. 2011; Christian et al., 2015). Veitch et al. (2011) showed that parental satisfaction with the quality of their local parks was associated with less computer time, and that greater public open spaces were associated with less TV viewing among children. Another study showed that spending a lot of time outside is one of the most consistent predictors of reduced screen-based activities in youth (Leblanc et al., 2015). Research on the association between adolescents' perception of an activity-friendly environment and screen-based activities within the European context is scarce, and comparison with previously mentioned studies might be problematic based on the different cultural backgrounds. These findings may then be interpreted as that in Central Europe adolescent perception may play at least some role in their actual experiences with screen-based activities.

*The environmental setting of behaviour*

We found that sufficient physical activity was not associated with the degree of urbanization among adolescents. Moreover, we found that adolescents in small towns, towns and cities were more likely to be engaged in screen-based activities than those in villages. Research on the association between adolescents' screen-based activities and degree of urbanization in a European context is scarce. One exception is a study of young Swiss children, which showed that the levels of screen-based activities were not explained by the built environment (Bringolf-Isler et al., 2015). In addition, some studies in the review of Pate et al. (2011) investigated the associations between measures of sedentary behaviour and the degree of urbanization among sampled children and adolescents, but this yielded heterogeneous studies, i.e. studies of Davey (2008) conducted in China and of Kourlaba et al. (2009) conducted in Greece found that living in urban areas was related to higher levels of screen-time activities. On the other hand, studies of Loucaides et al. (2004) conducted in Cyprus and of Gordon-Larsen et al. (2000) in the US did not find any association between the studied variables. This could guide the choice of parents regarding a place for living, but this is rather unlikely, as other factors determine this. However, our findings indicate that it is really important to support parents and adolescents in small towns, towns and cities in being less sedentary and in creating an environment supporting their active living.

This study showed that screen-based activities and physical activity were not associated with the accessibility of sports facilities, the exception being the availability of an area for skating or a tennis court in association

with physical activity. An explanation of our results might be that those children who are attending schools with higher standards, such as those with accessibility of an area for skating or a tennis court, are better off and are also prone to be more physically active. Previous studies have demonstrated that some physical environmental characteristics in the school setting can influence students' activity level (Haug et al., 2008; Haug et al., 2010; Czerwinski et al., 2015; Sallis et al., 2001; Davison et al., 2006). After the school day has ended, adolescents are more likely to do screen-based activities and less likely to engage in positive behaviours, such as physical activity (Mahoney, 2011). Consequently, it is useful for adolescents to have at least access to use these sport facilities after the end of school day. Our findings indicate that it is also important to support adolescents with active use of sports facilities in schools and outside schools, because access to sports facilities alone does not guarantee their use. Our findings from young adolescents may then be interpreted as meaning that accessibility of sport facilities may play at least some role in their physical activity and screen-based activities.

Last but not least, we found that screen-based activities were not associated with active breaks at school, and physical activity was negatively associated with active breaks at school among adolescents. Previous studies (Haug et al., 2008; Verstraete et al., 2006) have shown that promoting adolescents' physical activity through active breaks can contribute to achieving the daily recommended physical activity levels. However, our finding contradicts the findings of previous studies, as we found physical activity to be lower in the case of active recess. It is probably not only an exceptional case, because similar findings were found among adolescents from the Czech Republic (Sigmundova, oral comunication), in a country where physical activity has a better tradition. A possible explanation of our findings could be that young people with access to environmental resources, such as physical activity during breaks at school, may not necessarily use them (Haug et al., 2008). During breaks, students are free to do what they want. Another explanation could be that the information on active breaks as given by the school management might differ from the students' own 'experience of activity', thus explaining the negative association with physical activity. Finally, active breaks may be a response to low physical activity levels and then are not fully able to counteract these low physical activity levels. Based on our cross-sectional data, we cannot discriminate between these three explanations. Further research is needed to fully understand which of these mechanisms may explain this rather unexpected finding.

### 8.2.2 Physical activity, screen-based activities and country aspect

The studies reported in Chapters 4 and 5 were conducted in Slovakia and the Czech Republic, and we found no statistical differences in the characteristics and findings between these two countries. An explanation might be that both countries were together as Czechoslovakia until 1993, when they separated, and that they still share a very similar cultural and linguistic background. In general, the Czech Republic and Slovakia do not differ that much (Veselska et al., 2011). We expanded our research sample in Chapter 7; the data for that chapter had been collected in four middle European countries (Slovakia, the Czech Republic, Poland and Germany). Three of these countries (Slovakia, the Czech Republic and Poland) share similar cultural, historical and geopolitical background as Visegrad-4 countries. Moreover, in the past they were the part of the Eastern Bloc (Comecon and the Warsaw Pact), with a communist regime during most of the second half of the 20th century. Comparable characteristics may be found partly in Germany, as this country was divided in Eastern and Western parts during this time period as well. The Eastern part was part of the Eastern Bloc as well, which is likely to have led to similar experiences. Given the large similarities in findings regarding these four countries, it might be expected that findings regarding physical activity and screen-based activities from this thesis apply to other Central European countries, too.

## 8.3 Methodological considerations

### 8.3.1 Quality of samples

The present study used large and representative samples of adolescents aged 11 to 15 years old, which represents a major strength of the study. Moreover, the response rates in all study samples used in this thesis were very high. Finally, we included a number of countries. A limitation of the present study might be that a small number of adolescents do not attend school and are educated by home schooling. Our study thus missed this group, but that will hardly affect its findings due to the small size of this group. Some data were based on information given only from one informant in the school management, and this may be quite different from students' experiences. Moreover, per school this regarded just one informant. Therefore, in future research we need to triangulate this data, using multiple types of informants and a large number of respondents per school at managerial level.

### 8.3.2 Quality of information

A further strength of this study is the use of validated measures that have been used in various studies and documented in a variety of reports and publications on both national and cross-national levels. A limitation of the present study might be that the data were based on adolescent self-reports, which can be inaccurate and biased by social desirability. The probability of under- or over-reporting was decreased by guaranteeing confidentiality, anonymity and privacy during self-administration of questionnaires in the absence of teachers. In addition, previous research has shown the high validity of the measures used by the present study (Brener et al., 2003; Currie et al., 2014). While self-reported data on psychological complaints are a rather preferred source of information, the validity and reliability of self-reported as well as measured physical activity or sedentary behaviour indicators are discussed heavily in the literature (Bobakova et al., 2015; Biddle et al., 2011; Corder et al., 2009; Slootmaker et al., 2009). For example, objectively measured physical activity and indicators of sedentary behaviour demand the compliance of respondents, and use of them during research might be difficult for several adolescents. On the other hand, the use of subjective measurement methods makes it possible to obtain more information about the domain and context in which an adolescent's physical activity and sedentary behaviour took place (De Meester et al., 2011). Moreover, regarding school policies, we fully relied on managers, which may have led to some bias in the information. Other sources of information may partially solve this problem, e.g. assessing the activities of schools related to these policies.

### 8.3.3 Causality and confounding

One of the strengths and at the same time a limitation of the study is the cross-sectional design of all the samples. Though our research samples provide information on a range of ages for the same period, the cross-sectional design limits the potential for making causal inferences. Taking into account the robustness of the associations and the fact that adjustment for potential confounders (age, gender, body mass index and family affluence) did not affect the associations that were found to a significant degree provides at least support for the robustness of these associations. However, this does not guarantee that the associations that we found were indeed causal. In particular, they might also be due to common causes, or to reverse causality. However, it should be noted that such common causes might even lead to longitudinal associations, implying that probably the best design to establish causality would be longitudinal or experimental, as a more final foundation of interventions.

## 8.4 Implications

Our study has several important implications for public health practice and policy, as well as for further research.

### 8.4.1 Implications for practice and policy

Our findings suggest that a relatively low level of physical activity and a high level of screen-based activities are very common among adolescents and that these levels are associated with potential determinants on several levels, as represented in the socio-ecological model. The findings of this thesis suggest that interventions based on the socio-ecological approach may be a good option to achieve change in adolescent lives. Following the theoretical framework of the socio-ecological approach (Sallis et al., 2006), preventive strategies should be targeted at each level of influence (intrapersonal level, perceived environment and environmental setting of behaviour).

*Intrapersonal level*

Firstly, we found that body image among girls was not associated with physical activity, whereas poor body image among boys was associated with less physical activity. Based on our findings, it seems that for health-promotion programmes to be successful they should consider gender-specific strategies aiming at girls and boys separately. Adolescent boys with a negative body image are less physically active than other boys, and therefore it could be effective to pay attention to this. This implies that at the intrapersonal level it is also important to take a closer look at the motivation for physical activity and possible barriers for it among adolescents, allowing for variation by gender.

Our study showed that the motives for physical activity were associated with the level of physical activity, and this association was again partially gender dependent. "Good child" motives and achievement motives were associated with a higher level of physical activity among boys and also among girls. Focusing on "good child" motives and achievement motives in planned programmes for the promotion of physical activity will probably fit the needs of both girls and boys and might increase their engagement in physical activity. At the same time, stressing social motives might be effective only among girls, while stressing health motives might be effective only among boys, as associations of these motives with physical activity differ by gender according to our results. This implies that to increase the efficiency and successful implementation of programmes for the promotion of physical activity of adolescents, adolescents' motives should be accounted for and that gender specific motives should be considered in the development and delivery of such interventions.

*The perceived environment*

We found that perceiving the environment as more activity-friendly was significantly associated with physical activity and screen-based activities among adolescents in four European countries. As adolescents spend approximately half of their days in school, the school day could also be organized in such a way that there are time and facilities available to enable everybody to be active for at least an hour each day. One suggestion could be to build school yards or other facilities nearby homes that are so intriguing that children cannot stay passive near them (Rintala et al., 2011). Even a small change in day-to-day routines at school, e.g. desks that can be lifted into standing positions, incorporating standing or even an activity as a part of the lesson might have a beneficial effect.

*The environmental setting of behaviour*

This study showed that the place where adolescents live was not associated with their physical activity, but that it was associated with their screen-based activities. Adolescents from small towns, towns and cities were at more risk for being more sedentary in comparison with adolescents from villages. This could guide the choice of parents regarding a place to live. Our findings imply that is really important to support parents and adolescents in small towns, towns and cities in being less sedentary and in creating an environment supporting their active living.

We found that physical activity and screen-based activities were not associated with the accessibility of sports facilities at school. One exception was a significant association between schools having an area for skating or a tennis court and physical activity among adolescents. Our results might be due to the fact that those children who are attending schools with higher standards, such as those with accessibility of an area for skating or a tennis court, are more well off and also more prone to be physically active. Our findings suggest that not only accessibility of sport facilities but also the perception of these facilities as activity-friendly may contribute to their active use. Moreover, availability and accessibility of sport facilities support active living of adolescents and should be regulated within the school environment and the family. This leaves the responsibility on families and children themselves to be active during weekdays and over the weekends, together as a family or by themselves (Rintala et al., 2011). We recommend that schools ensure at least the availability of and access to recreation facilities for after-school and youth-development programmes.

In conclusion, our findings on physical activity and screen-based activities and their potential determinants indicate that the ecological model of active living (Sallis et al., 2006) provides an appropriate and useful theoretical framework for creating implications for practice and policy. Understanding why adolescents are active or inactive in their

life could significantly contribute to the design and delivery of health-promoting interventions.

### 8.4.2 Implications for future research

Our findings suggest that Slovak adolescents could at the same time be physically active and still sedentary. The same pattern can be found in other European countries, such as Bulgaria, Albania, Ukraine or Croatia. Based on existing differences in physical activity and screen-based activities, it seems that such activities among adolescents should take into account different approaches for investment into the active living of adolescents.

The study samples used in this thesis provide information on a range of ages for the same period, but some data were based on information given only from the principal or vice-principal of the Slovak schools, and this may be quite different from students' experiences. Moreover, this involved just one informant per school, and how school management perceived e.g. active breaks at school might deviate from the perception of adolescents. Therefore, in future research we need to triangulate such data, using multiple types of informants and involving at managerial level a larger number of respondents per school.

Another implication for future research is connected to the measurement of physical activity and screen-based activities. Measurements of these variables are most commonly made by self-reported questionnaires and by objective measures. It seems that it is not easy to measure these variables among adolescents, because it may be problematic to sensibly sort out the strictly optimal amount of these activities. It has already been mentioned that adolescents can be active and still sedentary. The solution for this problem might be a change in the orientation of researchers, with more focus on measurable outcomes instead of on measures of the process itself. Next, the reliability and validity of physical activity and screen-based activities instruments are more and more questionable and should be explored further. Physical activity and screen-based activities among adolescents might be better measurable by instruments developed for measuring fitness, fatness, obesity and overweight.

We found cross-sectional associations between the studied adolescents' physical activity and screen-based activities and their potential determinants. Given the cross-sectional design of the present study, we could not make strong causal inferences. To disentangle causality, future longitudinal studies on these relations are needed. A time trend analysis could be used to explore the occurrence of physical activity and screen-time activities over time. In addition, some qualitative research and experimental research may also confirm the concepts. However, more research on this topic needs to be undertaken with the aim

of understanding how various other variables may influence adolescents´ physical activity and screen-time activities.

In conclusion, our findings indicate that the ecological model of active living (Sallis et al., 2006) is a useful theoretical framework for creating implications for future research in the field of potential determinants of physical activity and screen-based activities. For example, even a small change in day-to-day routines at school, such as desks that can be lifted into standing positions, incorporating standing or even an activity as a part of the lesson might have a beneficial effect.

## 8.5 Conclusion

Adolescents reported relatively little physical activity and rather many screen-based activities. These behaviours were associated with potential determinants on several levels based on the socio-ecological model, starting with the intrapersonal level (gender-specific role of body image and motives for physical activity), the perceived environment (positive influence of perception of the environment as activity-friendly) and the environmental setting of behaviour (degree of urbanization, some accessibility to sports facilities and active breaks). A better understanding of the potential determinants associated with physical activity and screen-based activities in adolescents are therefore essential in the field of prevention and health promotion. Preventive strategies should involve multiple levels, such as intrapersonal characteristics, perceived environment, behaviour setting (especially the school setting) and policy, and they should also target a wide range of active living across adolescents. Much can be gained also in regard to these relatively new challenges and approaches for adolescent public health.

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# Summary

Healthy active living during adolescence supports optimal health and growth of the individual. Physical activity and screen-based activities are important aspects of the health behaviour of adolescents. A low level of physical activity and a high level of screen-based activities are highly prevalent among Slovak adolescents. However, both types of behaviour are not merely opposites of each other, i.e. at the same time adolescents can be physically active and still have a high rate of screen-based activities. Moreover, physical activity and screen-based activities in adolescence have been found to be strongly associated with a wide range of health problems, though to date only a few studies have explored this relationship. Therefore, the general aim of this thesis was to examine the relationships of adolescents' physical activity and screen-based activities, and the associations of these behaviours with potential determinants (e.g. body image, motives to physical activity, school environment, degree of urbanization, perceived activity-friendly environment). Additionally, this thesis explores the role of gender, age and socioeconomic status in these associations.

Chapter 1 provides information on the key theoretical constructs of this thesis – physical activity, screen-based behaviour – and on the associations of these behaviours with their potential determinants. At the end of the chapter, the theoretical background, the general aim of the study, the research questions and the structure of the further thesis are presented.

Chapter 2 provides a description of the five study samples used in this thesis. It also provides information on the design of the study and on the measures and statistical analyses used.

Chapter 3 focuses on the association of body image with physical activity of adolescents, and on whether gender modifies these associations. We found that adolescents with a negative body image engage in regular sufficient physical activity less often than others, and that boys are more likely to be sufficiently physically active. A poor body image among girls did not affect their physical activity, whereas poor body image among boys was associated with a lower likelihood of reaching the recommended level of moderate to vigorous physical activity.

Chapter 4 explores the connection between the motives for physical activity and the level of physical activity in adolescence and whether this connection differs between boys and girls. We found that associations between motives for physical activity (social motives, health motives, "good child" motives, achievement motives) and the level of physical

activity differed somewhat by gender. We found that "good child" motives and achievement motives were associated with the level of physical activity among both boys and girls. Health motives were associated with sufficient physical activity only among boys, and social motives only among girls.

Chapter 5 regards the test-retest reliability of the motives for undertaking the physical activity items from the HBSC questionnaire among adolescents, and whether this reliability differs by gender, age group and country. We found a moderate agreement for most of these motives in the whole sample and also if stratified by gender, age group and country. After dichotomisation we observed moderate test and retest correlation coefficients for almost all examined items, such as "to have fun"; "to be good at sports"; "to win"; "to see my friends"; "to get in good shape"; "to look good"; "to please my parents"; "to be cool"; "to control weight" and "it is exciting". The only exceptions were three motives which had weak or trivial correlations.

Chapter 6 assesses whether the accessibility of sports facilities at school, active breaks and degree of urbanization are associated with physical activity and screen-based activities of adolescents, and whether these associations are modified by degree of urbanization. We found a significant association of physical activity of adolescents with schools having an area for skating or a tennis court and having active breaks. Furthermore, we found that adolescents in small and bigger towns were more likely to be engaged in screen-based activities than those living in villages. The association of physical activity and screen-based activities with accessibility of sports facilities at school and active breaks was not modified by the degree of urbanization.

Chapter 7 explores the association of the perception of activity-friendliness of the environment with physical activity and screen-based activities among adolescents. We found that if the environment ws perceived as more activity-friendly it was significantly more likely that adolescents met the recommendations for physical activity in all four European countries studied: the Czech Republic, Slovakia, Poland and Germany. Furthermore, we found that if the environment was perceived as more activity-friendly it was significantly less likely that adolescents' undertook excessive screen-based activities, in all four European countries studied.

Chapter 8 summarises and discusses the main findings in the context of the available knowledge. We found that adolescents reported relatively little physical activity and rather many screen-based activities. These behaviours were associated with potential determinants on several levels of the socio-ecological model. Regarding the intrapersonal level this regarded the gender-specific role of body image and motives for physical activity. Regardingthe level of the perceived environment this we found

a positive contribution of perceiving the environment as activity-friendly. And regarding the level of the environmental setting of behaviour this regarded the degree of urbanization, the degree of access to some sports facilities and active breaks.

Moreover, Chapter 8 also explores the strengths and limitations of the study and the study's implications for practice and policy, as well as for further research. Our findings imply a need for better understanding of the potential determinants associated with physical activity and screen-based activities of adolescents. Understanding why adolescents are active or inactive can significantly contribute to the design and delivery of preventive interventions. Preventive strategies should involve multiple levels, such as intrapersonal characteristics, the perceived environment and the behaviour settings (especially the school setting). In addition, our findings indicate that the ecological model of active living provides a useful theoretical framework for research on determinants of physical activity and screen-based activities. Our findings further suggest that adolescents can be physically active and still sedentary at the same time and that activities among adolescents should use varying approaches so that adolescents invest in active living. By adequately addressing these relatively new challenges, much can be gained for adolescent public health.

# Samenvatting

Gezond actief leven tijdens de adolescentie ondersteunt optimale gezondheid en groei van het individu. Fysieke activiteit en scherm-gebonden activiteiten zijn belangrijke aspecten van het gedrag van adolescenten. Weinig lichamelijke activiteit en veel scherm-gebonden activiteiten komen veel voor bij Slowaakse adolescenten. Echter, beide soorten gedrag sluiten elkaar niet, dat wil zeggen dat adolescenten ook fysiek actief kunnen zijn en tegelijkertijd ook veel scherm-gebonden bezig. Verder blijkt dat lichamelijke activiteit en schermgebruik in de adolescentie sterk kunnen samenhangen met een breed scala aan gezondheidsproblemen, hoewel deze samenhang tot op heden nog maar in een paar studies is onderzocht. Daarom was het algemene doel van dit proefschrift om de samenhang tussen de lichamelijke activiteit van de adolescenten en scherm-gebonden activiteiten te bepalen en na te gaan hoe gedragingen samenhangen met potentiële determinanten (bijvoorbeeld lichaamsbeeld, motieven voor lichamelijke activiteit, schoolomgeving, mate van verstedelijking, waargenomen activiteits-vriendelijke omgeving). Daarnaast verkent dit proefschrift de rol van geslacht, leeftijd en sociaal-economische status wat betreft deze samenhang.

In Hoofdstuk 1 wordt informatie gegeven over de belangrijkste theoretische constructen die een rol spelen in dit proefschrift - lichamelijke activiteit, schermgebruik - en op de samenhang van deze gedragingen met hun potentiële determinanten. Aan het eind van het hoofdstuk worden de theoretische achtergrond gepresenteerd, alsmede het algemene doel van het onderzoek, de onderzoeksvragen en de structuur van het proefschrift.

In Hoofdstuk 2 wordt een beschrijving gegeven van de vijf steekproeven die in dit proefschrift worden gebruikt. Ook geeft het hoofdstuk informatie over de opzet van het onderzoek en over de gebruikte meetinstrumenten en statistische analyses.

In Hoofdstuk 3 wordt ingegaan op de samenhang tussen lichaamsbeeld en lichamelijke activiteit van adolescenten en op de vraag of geslacht deze samenhang beïnvloedt. We vonden dat adolescenten met een negatief lichaamsbeeld vaak minder lichamelijk actief zijn dan anderen, en dat jongens vaker voldoende lichamelijk actief zijn. Bij meisjes hangt een negatief lichaamsbeeld niet samen met hun lichamelijke activiteit, terwijl bij jongens een negatief lichaamsbeeld samenhangt met een lagere kans om het aanbevolen niveau van matige tot krachtige fysieke activiteit te bereiken.

In Hoofdstuk 4 wordt de samenhang onderzocht tussen de motieven voor lichamelijke activiteit en het niveau van lichamelijke activiteit in de

adolescentie en de mate waarin dit verschilt tussen jongens en meisjes. We vonden dat de samenhang tussen motieven voor lichamelijke activiteit (sociale motieven, gezondheidsmotieven, motieven om een 'goed kind' te zijn, en prestatiemotieven) en het niveau van lichamelijke activiteit enigszins verschilt per geslacht. Motieven om een 'goed kind' te zijn en prestatiemotieven hangen zowel bij jongens als bij meisjes samen met het niveau van lichamelijke activiteit. Gezondheidsmotieven hingen alleen bij jongens samen met voldoende fysieke activiteit, en sociale motieven alleen bij meisjes.

In Hoofdstuk 5 wordt de test-hertest betrouwbaarheid onderzocht van de vragen aan adolescenten over motieven voor het lichamelijke actief zijn uit de Health Behaviour of School-aged Children (HBSC) vragenlijst, en of deze betrouwbaarheid verschilt naar geslacht, leeftijdsgroep en land. We vonden voor de meeste van deze motieven een matige overeenstemming in de hele steekproef, ook bij stratificatie naar geslacht, leeftijdsgroep en land. Na dichotomisatie van de items vonden we matige test-hertest correlatiecoëfficiënten voor bijna alle onderzochte items, zoals "plezier hebben"; "goed zijn in sporten"; "winnen"; "om mijn vrienden te zien"; "in goede conditie komen"; "er goed uitzien"; "om mijn ouders een plezier te doen"; "cool zijn"; "om mijn gewicht te controleren" en "het is spannend". De enige uitzonderingen waren drie motieven die zwakke of triviale correlaties hadden.

In Hoofdstuk 6 wordt nagegaan of de toegankelijkheid van sportfaciliteiten op school, actieve pauzes en de mate van verstedelijking samenhangen houden met de lichamelijke activiteit en het schermgebruik van adolescenten, en of deze samenhang wordt beïnvloed door de mate van verstedelijking. We vonden significante verbanden tussen de lichamelijke activiteit van adolescenten en de mate waarin scholen een terrein voor schaatsen of een tennisbaan hadden of actieve pauzes. Verder vonden we dat adolescenten in kleine en grotere steden vaker scherm-gebonden activiteiten ondernamen dan die in dorpen. De samenhang van lichamelijke activiteit met de toegankelijkheid van sportfaciliteiten op school en actieve pauzes en fysieke activiteiten en scherm-gebonden activiteiten werd niet beïnvloed door de mate van verstedelijking, en dat was ook niet het geval voor schermgebruik.

In Hoofdstuk 7 wordt de samenhang onderzocht tussen de mate waarin de omgeving wordt beschouwd als 'vriendelijk voor activiteiten' en lichamelijk activiteit en schermgebruik van adolescenten. We vonden dat als de omgeving gezien werd als 'vriendelijker voor activiteiten' de kans significant hoger was dat adolescenten de aanbevelingen voor fysieke activiteit zouden halen in alle vier Europese landen die werden bestudeerd: Tsjechië, Slowakije, Polen en Duitsland. Verder vonden we dat als de omgeving werd gezien als 'vriendelijker voor activiteiten' de kans significant lager was dat adolescenten overmatig schermgebruik

hadden , in alle vier Europese landen die werden onderzocht.

In Hoofdstuk 8 wordt een samenvatting gegeven en worden de belangrijkste bevindingen besproken in samenhang met de beschikbare kennis. We vonden dat adolescenten relatief weinig lichamelijke activiteit rapporteren en nogal veel schermgebruik. Deze gedragingen hingen samen met potentiële determinanten op verschillende niveaus van het sociaal-ecologisch model. Wat betreft het intrapersoonlijke niveau van dit model vonden wij dat geslacht de samenhang bepaalde met lichaamsbeeld en motieven voor fysieke activiteit. Wat betreft het niveau van de waargenomen omgeving vonden wij een positieve samenhang voor de perceptie van de omgeving als 'vriendelijk voor activiteiten'. Wat betreft het niveau van de context van het gedrag betrof dit de mate van verstedelijking, de mate van toegang tot sommige sportfaciliteiten en actieve pauzes van belang waren.

Bovendien worden in Hoofdstuk 8 de sterkten en beperkingen van het onderzoek besproken en de implicaties van de bevindingen voor praktijk en beleid, en voor verder onderzoek. Onze bevindingen laten zien dat we determinanten van lichamelijke activiteit en schermgebruik van adolescenten nog beter moeten gaan begrijpen. Dit begrip kan aanzienlijk bijdragen aan versterking van preventieve interventies. Preventieve strategieën zouden meerdere niveaus moeten omvatten, zoals intrapersoonlijke kenmerken, de gepercipieerde omgeving en de context van het gedrag (vooral de school). Bovendien laten uit onze bevindingen zien dat het ecologisch model van actief leven een nuttig theoretisch kader geeft voor onderzoek naar determinanten van lichamelijke activiteit en schermgebruik. Onze bevindingen suggereren verder dat adolescenten tegelijkertijd lichamelijk actief en sedentair kunnen zijn, en dat verschillende benaderingen het best kunnen worden gecombineerd om te bereiken dat adolescenten in actief leven investeren. Door deze relatief nieuwe uitdagingen adequaat aan te pakken, kan veel worden bereikt voor de gezondheid van adolescenten.

# Zhrnutie

Aktívny životný štýl, ako súčasť so zdravím súvisiaceho správania, podporuje optimálny rast a zdravie v období adolescencie. Fyzická aktivita a sedavé správanie predstavujú v rámci aktívneho životného štýlu dva dôležité aspekty. Nízka úroveň fyzickej aktivity a vysoká miera sedavého správania sa u slovenských adolescentov vyskytuje pomerne často. Je však potrebné poznamenať, že tieto dva typy správania nemusia byť nutne vo vzájomnom protiklade, t.j. v rovnakom čase môžu byť adolescenti fyzicky aktívni a zároveň stále tráviť čas sedavým spôsobom života. Navyše sa v uplynulých rokoch zistilo, že fyzická aktivita a sedavé správanie (najmä v súvislosti s vnímaním prostredia, v ktorom žijeme) sú v období dospievania silne spojené so širokou škálou zdravotných problémov. Doteraz tieto súvislosti u dospievajúcich bližšie skúmalo iba niekoľko štúdií. Práve preto bolo hlavným cieľom tejto práce preskúmať vzťah fyzickej aktivity a sedavého správania u adolescentov s potenciálnymi determinantami (napr. vnímaním vlastného tela, motívmi k fyzickej aktivite, školským prostredím, miestom bydliska, prostredím podporujúcim fyzickú aktivitu). Táto práca navyše skúmala tiež úlohu pohlavia, veku a socio-ekonomických rozdielov vo vyššie spomínaných súvislostiach.

Kapitola 1 poskytuje informácie o kľúčových teoretických konštruktoch tejto práce – venuje sa fyzickej aktivite a sedavému správaniu – a ich súvislostiam s potenciálnymi determinantami, ktoré ho môžu ovplyvňovať. V závere kapitoly sú prezentované teoretické východiská, všeobecný cieľ štúdie, výskumné otázky a štruktúra prezentovanej práce.

Kapitola 2 poskytuje opis piatich študijných vzoriek použitých v tejto práci. Prináša taktiež informácie o dizajne štúdie, použitých meracích nástrojoch a štatistických analýzach.

Kapitola 3 sa zameriava na súvislosť medzi vnímaním vlastného tela s fyzickou aktivitou u adolescentov a na potenciálny vplyv pohlavia na tieto súvislosti. Zistili sme, že adolescentní chlapci, ktorí vnímajú svoje telo negatívne, sa venujú pravidelnej fyzickej aktivite menej často než ostatní, hoci je potrebné dodať, že chlapci celkovo v porovnaní s dievčatami majú vyššiu tendenciu byť dostatočne fyzicky aktívni.

Kapitola 4 skúma súvislosť medzi motívmi k fyzickej aktivite a úrovňou fyzickej aktivity v období dospievania s možnými rodovými rozdielmi. Zistili sme, že vzťah motívov k fyzickej aktivite (sociálne motívy, zdravotné motívy, motívy „dobrého dieťaťa“, výkonové motívy) s úrovňou fyzickej aktivity má svoje špecifiká v závislosti od pohlavia. Motívy „dobrého dieťaťa“ a výkonové motívy súvisia s úrovňou fyzickej aktivity ako u chlapcov tak aj u dievčat. Zdravotné motívy však súviseli s dosta-

točnou fyzickou aktivitou len u chlapcov a sociálne motívy mali súvislosť s dostatočnou fyzickou aktivitou len u dievčat.

Kapitola 5 sa zameriava na test-retestovú reliabilitu meracieho nástroja HBSC štúdie zameraného na mapovanie motívov k fyzickej aktivite u adolescentov, a zároveň skúma či sa táto reliabilita líši podľa pohlavia, veku a krajiny. Zistili sme, že motívy podporujúce fyzickú aktivita v dotazníku HBSC ukázali uspokojivú reliabilitu u väčšiny motívov v celej vzorke a tiež po stratifikácii podľa pohlavia, vekovej skupiny a krajiny. Po dichotomizácii sme zaznamenali uspokojivú reliabilitu pre takmer všetky skúmané položky, t.j. pre motívy „zabaviť sa"; „byť dobrý v športe"; „vyhrať"; „vidieť sa s mojimi kamarátmi/kami"; „dostať sa do dobrej formy"; „vyzerať dobre"; „potešiť mojich rodičov"; „byť „cool""; „udržiavať svoju hmotnosť" a „pretože je to vzrušujúce". Jedinou výnimkou boli tri motívy so slabou („dostať sa do dobrej formy"; „teším sa z pohybu") alebo triviálnou („zlepšiť moje zdravie") úrovňou reliability.

Kapitola 6 zisťuje nakoľko prístupnosť športových zariadení v škole, aktívne prestávky a miesto bydliska adolescentov (mesto vs. vidiek) súvisí s ich fyzickou aktivitou a sedavým správaním a či sú tieto súvislosti ovplyvňované stupňom urbanizácie (miestom bydliska dospievajúcich, mesto vs. vidiek). Zistili sme významnú súvislosť medzi fyzickou aktivitou u adolescentov a školami, ktoré sú vybavené nadštandardnými športovými zariadeniami ako je klzisko alebo tenisový kurt. Okrem toho sme zistili, že adolescenti žijúci v malých a väčších mestách sledovali televíziu a využívali počítač viac ako adolescenti žijúci na vidieku. Súvislosť medzi prístupnosťou športových zariadení v škole a aktívnymi prestávky s fyzickou aktivitou a sedavým správaním nebolo ovplyvnené stupňom urbanizácie.

V kapitole 7 sa skúma súvislosť vnímania prostredia ako podporujúceho fyzickú aktivitu so samotnou mierou fyzickej aktivity a sedavým správaním adolescentov. Zistili sme, že vnímanie prostredia ako podporujúceho fyzickú aktivitu súviselo s vyššou mierou fyzickej aktivity u adolescentov v štyroch skúmaných európskych krajinách (Českej republike, Slovensku, Poľsku a Nemecku). Okrem toho sme zistili, že vnímanie prostredia ako podporujúceho fyzickú aktivitu súviselo s tým, že adolescenti trávili menej času pri sledovaní televízie a používaní počítača v štyroch uvedených európskych krajinách.

V kapitole 8 sú zhrnuté a diskutované hlavné zistenia predchádzajúcich kapitol v kontexte dostupných poznatkov. Zistili sme, že adolescenti uvádzajú pomerne nízku mieru fyzickej aktivity a veľa času trávia sledovaním televízie a používaním počítača. Toto správanie bolo spojené s potenciálnymi determinantami na viacerých úrovniach socio-ekologického modelu. Na intrapersonálnej úrovni súvisela fyzická aktivita s rodovo špecifickou úlohou vnímania vlastného tela a motívmi k fyzickej aktivite; na úrovni vnímaného prostredia súviseli fyzická aktivita a sedavé sprá-

vanie s pozitívnym prínosom vnímania prostredia ako podporujúceho fyzickú aktivitu; a na úrovni environmentálneho nastavenia správania súviseli so stupňom urbanizácie, prístupnosťou niektorých športových zariadení v škole a aktívnymi prestávkami.

Okrem toho kapitola 8 skúma silné a slabé stránky štúdie a odporúčania štúdie pre prax a politiku, ako aj pre ďalší výskum. Naše zistenia naznačujú potrebu lepšieho pochopenia potenciálnych determinantov správania spojeného s fyzickou aktivitou a sedavým správaním u adolescentov. Pochopenie toho, prečo sú adolescenti aktívni alebo neaktívni, by mohlo výrazne prispieť k návrhu a realizácii preventívnych a zdravotníckych intervencií a programov. Preventívne stratégie by mali zahŕňať správanie adolescentov na viacerých úrovniach, ako sú intrapersonálne charakteristiky, vnímanie prostredia kde žijeme a našim environmentálnym nastavením (najmä v školskom prostredí, v ktorom trávia adolescenti väčšinu svojho času počas dňa). Okrem toho naše zistenia naznačujú, že ekologický model aktívneho životného štýlu je užitočným teoretickým rámcom pre výskum možných determinantov fyzickej aktivity a sedavého správania. Naše zistenia tiež naznačujú, že adolescenti môžu a vedia byť v rovnakom čase fyzicky aktívni a zároveň tráviť čas sedavým spôsobom života. Navyše by sa u adolescentov v prípade fyzickej aktivity a sedavého správania mali využívať rôzne prístupy k dosiahnutiu aktívneho životného štýlu. Prostredníctvom adekvátneho riešenia týchto relatívne nových výziev a prístupov je možné získať veľa informácií pre verejné zdravie adolescentov.

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# About the author

Jaroslava Kopcakova was born on 3rd February 1986 in Bardejov. She graduated at the Faculty of Arts, PJ Safarik University in Kosice and received her Master degree in Psychology in 2011. Her diploma thesis (Risk behaviour of adolescents in the context of psycho-social factors) was based on Health Behaviour in School-aged Children study data as she participated as an administrator in data collection in 2010. During her study she was interested in field of family and developmental psychology, and she worked as a research assistant at KISH. Moreover, she was working as a volunteer in the helpline for child and in Children organization FÉNIX with focus on children and adolescents´ leisure-time activities and supporting their healthy development. At present time, she is researcher at the Department of Health Psychology, Faculty of Medicine at Pavol Jozef Safarik University in Kosice. During her doctoral studies, as well as in her ongoing work at the university, she is focused on research in health psychology and public health with particular focus on physical activity and sedentary behaviour in the context of psychosocial determinants especially in adolescents. Moreover, she is participating in several projects of national research agencies (APVV, VEGA), international or European research projects (VIPPA2, 7RP SOPHIE HEALTH, HBSC, International Visegrad Fund). Currently, she is involved in Care4Youth study oriented on healthy development of children and adolescents with emotional and behavioural problems paying particular attention to their trajectory in the systems of care and as a member of Health Behaviour in School-aged children study (HBSC) she is focused on healthy development of youth. Research is oriented on health and health-related behaviour among school-aged children within their social context. Moreover, within HBSC study she is participated on study oriented on objective measures of physical activity among adolescents. Since 2012 she is a member of the European Health Psychology Society.

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